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

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

(a) Title of the proposed PoA:	Biomass residues power generation Programme
(b) Current version number of the PoA-DD:	1.0
(c) Date the PoA-DD was completed:	31/05/2012

A.2. Purpose and general description of the PoA

General operating and implementing framework of the proposed PoA

The Biomass residues power generation Programme (hereafter referred to as "the PoA") aims to promote and support the implementation, replacement or retrofit of power-and-heat plants, utilizing biomass residues[1] as primary fuel. Extra electricity is likely to be exported into the electrical distribution grid, displacing the equivalent power generated from a fossil-fuel intensive baseline energy mix.

To assist project developers to invest in and/or to implement biomass residues power-and-heat plants, Standard Bank Plc has developed the PoA under which individual projects could join as a CDM Project Activities (CPA). The PoA mainly provides a platform for overcoming institutional, financial and structural hurdles for the development of biomass-residue (co-)fired power-and-heat projects.

Standard Bank Plc is the coordinating and managing entity (CME) for this PoA. Standard Bank Plc or any of its affiliate will act as the Programme Manager and will assess project activities before submission to the DOE for CPA inclusion.

In quality of programme manager, it will be the responsibility of the CME to:
- design the overall program,
- develop and manage an appropriate operational structure for the PoA,
- provide support and guidance to all stakeholders,
- enforce compliance of the technology and the CPA(s) of potential independent implementers with PoA requirements,
- act as a liaison with Designated National Authority, Designated Operational Entities, and the CDM Executive Board,
- be responsible for data collection, management and monitoring activities,
- monetize the carbon credits generated by the PoA,
- oversee all institutional communication regarding this PoA.

Standard Bank Plc will enter into a contractual agreement with each CPA implementer, giving Standard Bank Plc the legal rights to deal with the carbon credits that will be generated from these projects and

[1] Biomass residues is the biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries (e.g. sugar cane fibre, including tops or leaves, sawmill waste). This shall not include municipal waste or other waste that contain fossilized and/or non-biodegradable material (however, small fractions of inert inorganic material like soil or sands may be included).

monitor the project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA. The conditions for participation shall be in line with the eligibility criteria of the projects for inclusion in the PoA and shall be elaborated in the agreements between Standard Bank Plc and the project developers or other entities.

Policy/measure or stated goal of the PoA

The stated goal of the PoA is the promotion and support the implementation, replacement or retrofit of power-and-heat plants, utilizing biomass residues as primary fuel.

South Africa is endowed with abundant biomass residues existence from agribusiness industries, with a significant potential for power-and-heat plants implementation, replacement or retrofit in order to increase the levels of power and heat generation from renewable resources in the country. Still, to date the main energy resource in South Africa is coal, which contributes about 88% of the country's total electricity. However, the country recently experienced a decrease in its reserve margin, which forced it to embark on a number of interventions in early 2008. In some instances, load shedding had to be used as the last resort in order to prevent a system-wide blackout. (Odhiambo, 2009)

Emissions from the power sector amounted to 222 million tons of CO_2 in 2007, which ranked South Africa as the eighth country with the highest CO_2 emitting power sector worldwide. Eskom, the country's electricity public utility, operates 3 of the top-25 highest CO_2 emitting power generating plants in the world. (Center for Global Development, 2007)

South Africa's renewable energy policy to date has largely been driven by a 10,000 GWh target by 2013 and renewable energy project subsidies offered through the REFSO[2]. In March 2009 a Renewable Energy Feed-In Tariff was published (National Energy Regulator of South Africa, 2009), which has resulted in a great interest by Independent Power Producers to develop renewable energy projects in South Africa[3]. Nonetheless, under existing renewable energy policy few renewable energy projects for electricity generation have been deployed. (Edkins, Marquard, & Winkler, 2010)

Therefore as mean to durably enhance biomass-to-power practices in South Africa, this Programme of Activities will enable biomass-residue producers/owners to realize biomass-to-power projects and lock additional revenues by entering into an agreement with CME and including their expected facilities as CDM Project Activities under the PoA framework. Emissions from fossil-fuel combustion and/or carbon-intensive grid power generation will be avoided by recovering biomass residues for utilization in power-and-heat plants which would not be implemented/replaced/retrofitted in the absence of the proposed PoA.

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

The proposed PoA undertaken by Standard Bank Plc is a voluntary action since no laws or regulation in South Africa obligates the generation of power and heat from biomass residues.

The PoA meets the South Africa Sustainable Development requirements as published by the DNA (South Africa DNA, 2004).

SD criteria	Sustainable development requirements	PoA Responses
Social	Does the project contribute to social	CDM Project Activities included under this PoA will generate additional employment opportunities throughout South Africa

[2] Renewable Energy Fund Subsidy Office

[3] The tariffs for wind energy and concentrating solar power are among the most attractive worldwide, but biomass energy do not qualify under the REFIT guidelines yet.

	development in South Africa?	with a focus on local communities. Moreover by contributing to renewable energy generation in South Africa, this PoA will serve the improvement of quality of life of the South African people currently confronted with a national shortfall, including electrification opportunities in rural areas.
Economic	Does the project contribute to national economic development?	This PoA will enable power-and-heat plants to be developed or expanded throughout South Africa and help creating an additional revenue stream within the national agro-industry, especially in rural area. Foreign exchange requirements are likely to be reduced because of fossil fuel imports reduction, which will also decrease the cost of energy. Besides, the PoA will enable technology transfer to South Africa by involving world-class power-and-heat equipments and skills to be durably set up locally and replicable throughout the programmatic approach.
Environment-al	Does the project conform to the National Environmental Management Act principles of sustainable development?	The proposed PoA is desirable in that it will aid in addressing the current electricity supply constraints in South Africa. This type of electricity generation facility is more environmentally friendly than the coal-derived power currently serving much of the regional electrical distribution grid. Coal-derived power plants tend to emit more harmful gasses, such as sulphur dioxide and nitrogen oxides, and are more carbon-intensive, as well as being unsustainable in the long-term. The PoA will promote the recovery and utilization of biomass residues currently abandoned or incompletely tapped (e.g. "green harvesting" amongst certain sugar cane growers/suppliers, decreasing the burning of sugar cane and associated environmental impacts).
General acceptability	Is the distribution of benefits reasonable and fair?	In the light of the above, CDM Project Activities included under this PoA will bring benefits to both the participating companies and the local communities involved, as well as global benefits at the national level.

A.3. CMEs and participants of PoA

a) Coordinating or managing entity of the PoA as the entity which communicates with the Board

The entity that manages and oversees communication with the Designated Operational Entity, the UNFCCC secretariat and the Executive Board is Standard Bank Plc.

Standard Bank Plc is a bank authorised and regulated by United Kingdom Financial Services Authority providing a range of banking and related financial services. It is a member of the London Stock Exchange, the London Bullion Market Association, the London Metal Exchange, the London Platinum and Palladium Market and is Chairman of the London Platinum and Palladium Fixing and has two seats on the New York Mercantile Exchange (COMEX Division). The franchise of Standard Bank Plc and its subsidiaries focuses on emerging markets - primarily debt, interest rate, equity and currency products and natural resources.

b) Project participants being registered in relation to the PoA

Standard Bank Plc is the only project participant being registered in relation to 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)
Republic of South Africa (host)	Standard Bank Plc (Private entity)	No
United Kingdom of Great Britain and Northern Ireland	Standard Bank Plc (Private entity)	No

A.5. Physical/ Geographical boundary of the PoA

The boundary of a PoA is defined as the geographical area within which all the CPAs included in the PoA will be implemented. The geographical boundary of the PoA will cover the 9 provinces of South Africa.

Figure 1: *Global location of the PoA (source: United Nations Cartographic Section)*

A.6. Technologies/measures

The technology or measures to be employed by each CPA fall into Sectoral Scope 1: Energy Industries (renewable sources) as it concerns the implementation, replacement or retrofit of biomass-residue (co-) fired power-and-heat plants.

A typical CPA will consist in processing biomass residue for the generation of process heat and electricity through boilers and turbo-alternators. Excess of electricity may be exported into the electrical distribution grid of South Africa.

Power-and-heat plants encompass two broad categories of power plants:

- cogeneration plants (power-and-heat plant in which at least one heat engine simultaneously generates both heat and power) and
- plants in which heat and power are produced at the same installation although not necessarily in cogeneration mode, e.g. heat is extracted directly from a common heat header that also supplies heat to heat engines for power generation.

These two possible configurations may employ different technologies of thermal energy and electrical energy under various arrangements, with biomass residues as primary fuel.

Thermal energy:

Boilers

The thermal energy generated from biomass firing in the boiler furnace is transferred to the water through the heat transfer surfaces of the heat exchangers / pressure parts, which is then converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

Boilers mainly consist of the following parts:
1. Pressure parts – form heat transfer area, holds steam, water and various mountings.
2. Furnace fuel combustor –designed to burn efficiently a particular type of biomass or any compatible biomass fuel.
3. Accessories – for various systems like water treatment, storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, flue gas discharge, ash discharge & handling, electrical systems, equipment safety & controls.

The type of boilers and the capacity range vary according to the CPA's requirement and choice. Various types of boiler shall be considered under these activities like smoke tube / water tube type or combination of these types. These boilers can be packaged / field erected / site assembled with refractory lined or water walled type integral /external furnace.

The water/steam drum is mounted on the top of the water tube type boilers. In smoke tube type boiler shell is mounted side wise of the external refractory lined /water walled furnace or have integral furnace. The boilers with Fluidized Bed combustors (FBC) have in bed heat exchanger/s inside the furnace & are connected externally, to the main heat exchangers / boiler shell/water-steam drum, with risers and down comer pipes. The boilers are designed with single or multi flue pass design, with furnaces having forced / induced / balanced draught, as per the boiler model, capacity and by biomass fuel properties.

Heaters

The biomass fired heaters consist of thermic fluid / thermal oil heaters, pressurized and non-pressurized hot water generators, which work on closed loop pipe line system, for transferring the thermal energy indirectly, to the process through a heat transfer medium like thermic fluids / thermal oil or pressurized / non pressurized water.

The biomass-fired heaters are similar to the boilers, as both pick up the heat from the biomass fuel combustion & transfer it to the process/heat utilities.

The heaters transfer the thermal energy in the form of heat to the user, which could be a process or heat utilities in a closed loop piping system. The heater consists mainly of the following parts:

1. Heat Exchangers – form the heat transfer surface of the heater,
2. Furnace fuel combustor –designed to burn efficiently a particular type of biomass or any compatible biomass fuel,

3. Accessories - for various systems like fuel storage, fuel handling and feeding heat transfer fluid/water pipe lines, fans and draught system, flue gas discharge, ash discharge and handling, electrical system, equipment safety and controls, de-aerator and expansion Tank, heat transfer fluid/treated water system and storage.

The heaters are designed with a single / two or multi flue pass design, with furnaces having forced / induced / balanced draught, as per model and capacity and biomass fuel properties.
The type of heater and the capacity and range vary according to the user's requirement and choice. The biomass fuels are burnt in the combustors or furnaces of the heaters. The furnaces are lined fully or partly with refractory material. The combustion system of the heaters is similar to the boilers.

Electrical energy:

Turbines

When steam is used for electrical energy generation using steam turbines, two energy conversions are involved: converting the thermal energy of the steam into kinetic energy in the turbine and using a rotary generator to convert the turbine's mechanical energy into electrical energy.

A steam turbine consists of one or more rotors (rotating discs) mounted on a drive shaft, alternating with a series of stators (static discs) fixed to the turbine casing. The rotors have a propeller-like arrangement of blades at the outer edge.

Steam acts upon these blades, producing rotary motion. The stator consists of a similar, but fixed series of blades that serve to redirect the steam flow onto the next rotor stage. A steam turbine often exhausts into a surface condenser that provides a vacuum. The stages of a steam turbine are typically arranged to extract the maximum potential work from a specific velocity and pressure of steam, giving rise to a series of variably sized high and low pressure stages. An alternator/generator will be determined case by case according to the requirement for each CPA.

Each CPA will feature state-of-the-art monitoring equipment while the staff involved will be trained to properly operate, maintain and calibrate the monitoring system. Detailed technical description of the CPA installations and monitoring system is to be provided in each CPA-DD.

A.7. Public funding of PoA

The PoA does not expect to involve any public funding according to the OECD definitions for Official Development Assistance (ODA).

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (EB 65, Annex 3, Version 01.0):

- *Additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur.*
- *The CME shall demonstrate that compliance with the additionality-related eligibility criteria set in the PoA design document will ensure that all the relevant additionality-related guidelines, tools or any requirements embedded in the methodologies are met.*

Barriers faced by the proposed PoA

<u>Policy barriers</u>

A recent Renewable Energy Barriers assessment for South Africa released by an Open Climate Network partner has highlighted how shifting policies stall South Africa's renewable energy growth (Pienaar, 2011).

As long ago as 2003, government committed to increase the contribution of renewable energy in meeting the country's growing energy needs, but has only relatively recently introduced a number of policy initiatives to promote the use of renewable sources for energy generation.

The Integrated Resource Plan of 2010, for example, increased its target for electricity production from renewable energy sources to 17.8GW by 2030 following public consultations[4]. Many analysts question the ambition of this target[5], which would represent less than 10% of projected 2030 electricity demand. Ensuring that it is met (if not exceeded) will depend on finalizing and making operational a feed-in tariff and associated procurement rules, a process which has been repeatedly stalled over the last two years.

The Renewable Energy Feed-In Tariff (REFIT) guidelines, issued by the National Energy Regulator of South Africa (NERSA) in March 2009, were designed to "kick start and stimulat[e] the renewable energy sector" in South Africa. As elsewhere, REFIT essentially would pay a guaranteed fixed rate for a prescribed number of years to renewable energy generators for supplying electricity to the power grid, thus promoting the creation and sustainability of renewable energy (RE) providers and technology. However, REFIT has encountered several barriers to implementation:

(i) Wariness of utility monopoly, as a result of the conflict of interest apparent in Eskom's position as the national utility and its role as buyer of electricity from IPPs.

(ii) Shifting policies and regulations, contributing to investor uncertainty: since the Electricity Regulations on New Generation Capacity promulgated in August 2009, initially sought to build confidence among potential RE independent power producers by clarifying the roles and authority of sector actors, NERSA announced early 2011 its intention to review and probably decrease the tariffs set in March 2009, even though no power had yet been purchased at these initial rates. This latest shift in a long history of policy u-turns by government and state agencies, also complicates the streamlined REFIT approach by reintroducing doubts about the identity of the buyer, and introducing extensive Ministerial discretion to the process of determining which power procurement projects would be prioritised, once again shaking investor confidence.

(iii) Legal challenges to REFIT's bidding process, as the DoE and Treasury have expressed concern that the REFIT may not be legally compliant with government procurement rules. They have reportedly also indicated that they did not want to repeat some financial errors associated with REFIT programs in other countries.

<u>Other barriers likely to be faced at CPA level</u>

- Investment barrier
- Technological barrier
- Barrier due to prevailing practice

[4] Electricity Regulations on the Integrated Resource Plan 2010-2030 Regulation Gazette No. 9531 GG No. 34263 6 May 2011

[5] Experts opinion expressed in Daily Maverick on May 24, 2011 (http://dailymaverick.co.za/opinionista/2011-05-24-green-energy-nipped-in-the-bud)

➔ Given the barriers outlined above it is possible to state that in the absence of CDM, none of the implemented CPAs would occur. Therefore the proposed Programme of Activities is additional. CPA-specific additionality demonstration will however be undertaken at CPA level.

Table 1: *Assessment of applicable laws, regulations and policy*

Laws, policies and incentives applicable to power-and-heat from biomass residues, if any	Relevant extracts	Interpretation with regards to the proposed PoA
National Climate Change Response White Paper , 2011	*The White Paper aims to facilitate management of future climate impacts, as well as to promote, and contribute to, the stabilization of the greenhouse gasses (GHG) present in the atmosphere.*	This white paper is relevant to the proposed PoA, as the project activities would aid the sustainable development of the local sugar industry and displace some of the coal-derived power which services much of South Africa.
Integrated Resource Plan, 2010	*The installation of renewables (solar PV, CSP and wind) has been brought forward in order to accelerate a local industry.* *7.12 Further research is required on a number of potential technology options, including:* *3. Biomass (including municipal solid waste and bagasse)*	The latest Policy-adjusted IRP model's disaggregation of renewable energy technologies only explicitly displays solar PV, CSP and wind options, with no immediate commitment for biomass based technologies which 2020 levelised costs is foreseen as more expensive.
Renewable Energy Feed-In Tariff (REFIT) guidelines, 2009	*5. Renewable Energy Power Generator Qualification Criteria* *5.2. A Qualifying Renewable Energy Power Generator shall be defined as new investments in electricity generation using the following technologies:* *i. Landfill gas power plant;* *ii. Small hydro power plant (less than 10MW);* *iii. Wind power plant;* *iv. Concentrating Solar Power (CSP) plant.* *5.3. Qualification of other renewable energy technologies will be considered for inclusion in six months time.*	Biomass energy, although mentioned as part of South Africa's "largely unexploited valuable national resources", did not qualify in the REFIT when promulgated 3 years ago and has not been included yet.
National Environmental Management Act, 1998	*2.(4)(a)(iv) Sustainable development requires the consideration of all relevant factors - including that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;*	These general environmental governance framework edicts decision-making principles on matters affecting the environment, but does not explicitly refer to any type of renewable or non-renewable resources, let alone bio-residues promotion for power and heat.

As described in I.A.2, power-and-heat generation from biomass residues is not mandatory, thus the proposed PoA is a voluntary coordinated action from the CME to promote the implementation, replacement or retrofit of power-and-heat plants in South Africa.

Additionality will be demonstrated at CPA level, following the *Tool for the demonstration and assessment of additionality* (Annex 21, Version 06.0.0, EB65) approach to demonstrate and assess additionality as follows:

(a) Identification of alternatives to the project activity;

(b) Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible; and/or
(c) Barriers analysis; and
(d) Common practice analysis.

Nonetheless, it can be outlined that such voluntary coordinated action would not be implemented in the absence of the PoA except in another PoA or a stand-alone CDM project, given the barriers highlighted above which are also likely to be faced at CPA level. As required in eligibility criteria 7 of the below section, any compliant CPA will necessarily meet the relevant additionality-related guidelines, tools or methodological requirements applicable.

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

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (EB 65, Annex 3, Version 01.0), the eligibility criteria for inclusion of a CPA in the PoA is specified in Table 2.

Table 2: *Eligibility criteria of the proposed PoA*

Eligibility criteria		
Category	**N°**	**Description**
Boundary and location of the CPA	1	The geographical boundary of the CPA is within the Republic of South Africa, in consistence with the geographical boundary set in the PoA.
Double counting avoidance	2.1	The CPA is neither already included in another PoA or bundled CDM project activity, nor developed as a stand-alone CDM project.
	2.2	The industrial facility included in the CPA is uniquely identified.
	2.3	The CPA is either implemented by the CME or by another entity acknowledging its participation in the PoA with an agreement in place that transfers the emission reductions title to the CME.
Technology/measure specifications	3.1	The CPA-DD specifies the level and type of service provided by the technology/measure, as well as its performance.
	3.2	The technology/measure implemented within the CPA complies with national and/or international testing/certification requirements.
CPA start date	4	The start date of the CPA is verifiable through documentary evidence and is not prior to the start of PoA validation.
CPA crediting period	5	The crediting period of the CPA shall not exceed the length of the PoA (i.e. 28years) regardless of the time of inclusion of CPA in the PoA.
Compliance and application of the methodology ACM0006	6	The proposed CPA meets the applicability criteria and other requirements of the latest version of ACM0006 as outlined in section II.B.2. of the PoA-DD.
CPA additionality	7	The proposed CPA is additional, in compliance with the relevant requirements pertaining to the demonstration of additionality as outlined in section II.B.4. of the PoA-DD.
Undertaking of local stakeholder consultations and environmental impact analysis	8.1	A local stakeholder consultation has been conducted prior to the inclusion of the CPA.
	8.2	If applicable, an environmental impact analysis has been conducted prior to the inclusion of the CPA.
Non-diversion of ODA in case of Public funding	9	Confirmation that the CPA does not involve any public funding from Annex I Parties or that in case public funding is used, it does not result in diversion of Official Development Assistance (ODA)

Approval of CPA by the CME before inclusion	10	The CPA-DD has been reviewed by the CME and submitted to a DOE for inclusion into the PoA.

A CPA Inclusion Procedure that encompasses all provisions and procedures related to pre-inclusion due diligence shall be used as the foundation of compliance team activities. This manual is available to the DOE.

B.3. Application of methodologies

As detailed in I.A.2 above, the proposed PoA is an initiative to promote and support the implementation, replacement or retrofit of power-and-heat plants in South Africa, utilizing biomass residues.

Accordingly, the chosen methodology is approved consolidated baseline and monitoring methodology ACM0006 - Consolidated methodology for electricity and heat generation from biomass residues (Version 12.0.1). Its appropriateness to the CPAs to be included in the PoA is analyzed in II.B below.

No sampling plan is applicable since the CPAs to be included in the PoA are expected to be large industrial facilities uniquely designed and operated, thus individually monitored.

SECTION C. Management system

Standard Bank Plc is the programme manager, the Coordinating and Managing Entity (CME). As stated in paragraph A.2., it is responsible for:

- recruiting CPA implementers,
- ensuring that the proposed CPA is in compliance with PoA eligibility criteria,
- write the present PoA-DD and CPA-DD through service agreements with CDM consultants,
- collecting documents and supporting evidence required for PoA-DD and CPA-DD validation,
- communicating with the South Africa DNA and the CDM Executive Board,
- hiring DOE to conduct validation and verification,
- finding CERs buyers and distributing CERs revenues to CPA implementers,
- implement a monitoring database,
- conduct training for monitoring data,
- periodically collect monitoring data,
- write the monitoring reports.

Standard Bank Plc developed a CPA inclusion management system. This document details Standard Bank's CPA Inclusion Management System (CPA- IMS) for CPA inclusion and to meet requirements of EB 65, Annex 3. In particular the CPA IMS is aimed at ensuring that CPA additionality and eligibility criteria are thoroughly assessed and applied in developing and including CPAs and 'double counting' is avoided. This document includes:

1. Detailed process maps and process descriptions for CPA inclusion processes (e.g. procedures for technical review of inclusion of CPAs)
2. Description and detail of all CPA inclusion process supporting documents and tools
3. Clear definition of roles and responsibilities of personnel involved in the process of CPA inclusion
4. Description of record arrangements for training and capacity development of personnel, including a review of their competencies
5. Procedures to avoid double counting
6. Records and documentation control processes
7. Measures for continuous improvements of the management system
8. System compliance with EB requirements.

Note: The CPAs will be implemented by project developers, building on the Standard Bank Plc's relationship with individual project developers. Standard Bank Plc will enter into a contractual agreement with each CPA implementer. The contract would give Standard Bank Plc the legal rights to deal with the carbon credits that will be generated from these projects and monitor the project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA. The conditions for participation shall be in line with the eligibility criteria of the projects for inclusion in the PoA and shall be elaborated in the agreements between Standard Bank Plc and the project developers.

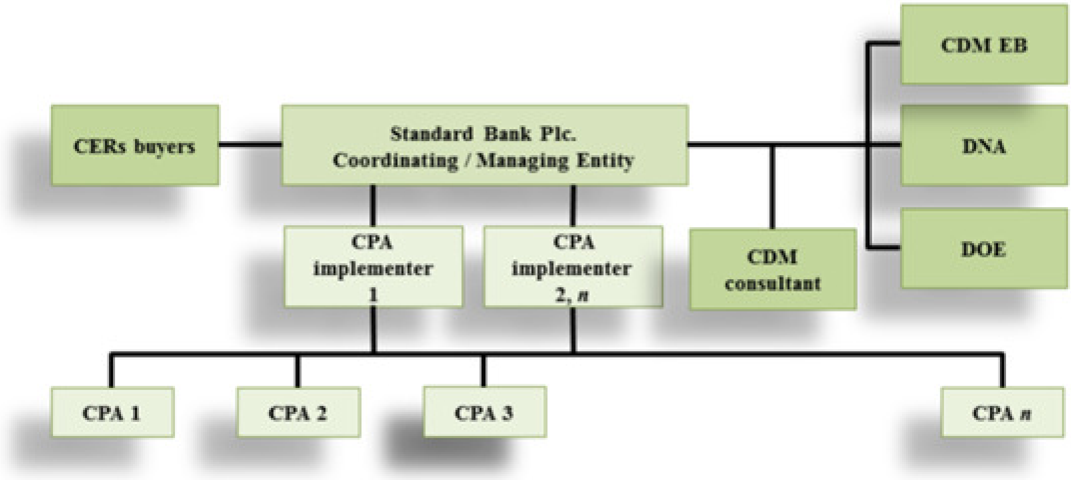


Figure 2: *Operational and management diagram*

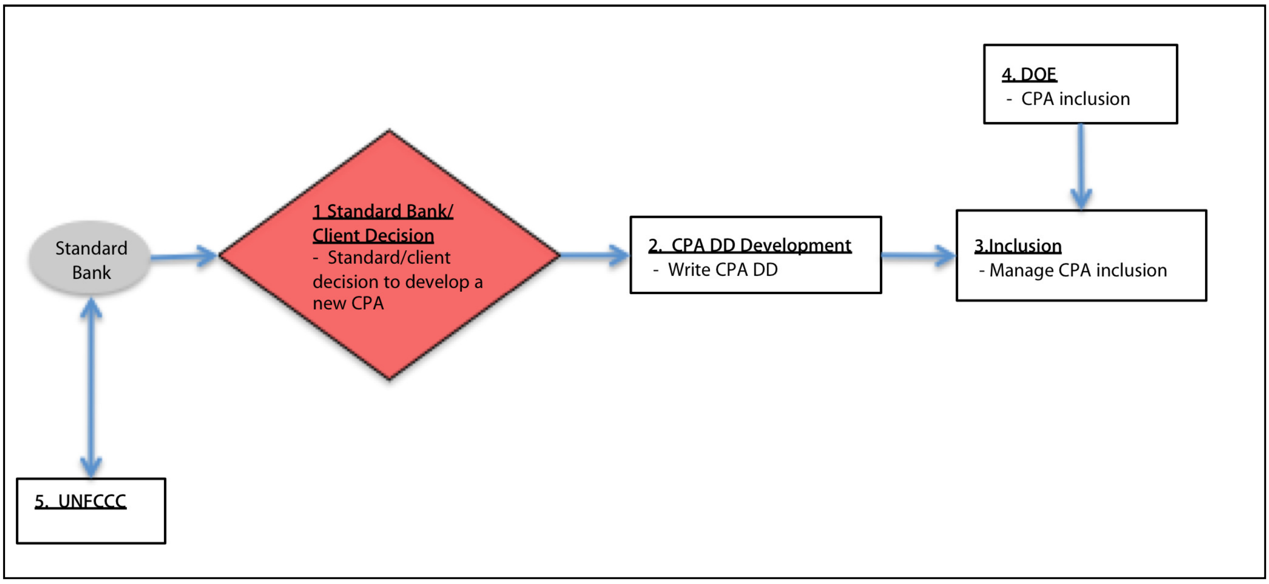


Figure 3: *CPA Inclusion Management System Process*

CPA implementer is responsible for:

- Construction/replacement/retrofit, installation, operation and maintenance of power-and-heat plant(s)
- Data checking and monitoring,
- Facilitate the CME and DOE required documents and access to sites as needed.

In addition, the CME shall set up the following operational elements to ensure management and oversight of the proposed PoA.

Record keeping system for each CPA under the PoA

The CME will establish and maintain a database for each CPA. The CME will record CPA information detail delivered by CPA implementer, as follows:

- Name of the CPA,
- Name of CPA implementer,
- Contact details of CPA implementer,
- Capacity of the power-and-heat plant and other relevant technical specifications of each CPA,
- GPS coordinates of each CPA (GPS coordinates of each energy facility),
- Verification status (number of verification and associated monitoring period),
- Emission reductions monitored and issued each monitoring period.

The CME will be responsible for the management of records and data associated with each CPA. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. The database will be updated using the data supplied by the CPA implementer. It will form the basis for the verification of CPA and be available for inspection by the DOE at any point in time.

System/procedure to avoid double accounting e.g. to 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

The database described above will be used to perform a double accounting check. Every new CPA will be compared to the already existing database and the list of project activities that are under validation or registered at the UNFCCC.

Moreover, as shown in *Table 3*, the CPA implementers will be made aware of the double accounting principle and will certify that the proposed CPA is not registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme. Should such a case occur, the CME will not proceed with inclusion of the corresponding CPA in the proposed PoA.

Table 3: *Procedure to avoid double-counting*

Criteria		Source	Result
1. No similar CPA already submitted as CPA under another PoA or CDM project. a. Research on UNFCCC's database b. Research with the South Africa DNA	True/ False?	a. Programme of Activities and CDM projects registries (UNFCCC) b. DNA projects/PoA portfolio	If "False", the CPA is not eligible to the PoA
2. Signed authorization letter from CPA implementer confirming their voluntary participation to the present PoA and confirming that the proposed CPA is not registered or under validation under the Clean Development Mechanism of the UNFCCC or any voluntary scheme as a single CDM project activity or as a CPA under another PoA	True/ False?	Signed authorization letter from the CPA implementer.	If "False", the CPA is not eligible to the PoA
3. Unique identification number based on unique geographic coordinates for each CPA under the PoA	True/ False?	Signed letter from the CPA implementer.	

Provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA

In order to avoid double accounting and to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA, a signed authorization letter from CPA implementershall be delivered to the CME confirming the following provisions:

- The CPA implementer certifies that CPA has not been registered (or declared under validation) and will not be registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme as a single CDM project activity or as an individual CPA under another PoA.
- The CPA implementer confirms his voluntary participation to the present PoA.
- The CPA implementer cedes its rights to claim and own emission reductions under the Clean Development Mechanism of the UNFCCC to Standard Bank Plc.

Moreover, the provisions to ensure that those operating the CPA are aware of, and have agreed that their activity is being subscribed to the PoA, will include the signature of:

- ✓ CPA inclusion agreement
- ✓ Emission reduction purchase agreement with each CPA/ project entity.

Prior to the start of the inclusion process for a new CPA under the PoA, the proposed CPA-DD will be reviewed by an independent compliance team appointed by CME. This compliance team, which shall be composed of personnel with adequate competencies, shall check if the CPA-DD is drafted following the lines of the PoA's generic orientations and if the proposed CPA does comply with the eligibility criteria stated above. The compliance team shall also check that the proposed CPA is neither registered or being registered under another PoA, nor registered or being registered as a standalone CDM Project Activity.

In order to ensure that the competencies of the members of the compliance team remain current, training and capacity development records in which all instruction sessions and workshops related to CDM procedures and overall cook stove project management shall be established. The training and capacity development records shall be part of the CPA Inclusion Procedure.

For each proposed CPA the findings of the compliance team will be summarized in a short report and submitted to CME management for final approval. In case the conclusion of the compliance team are not positive, the CPA implementer will have to carry out the requested changes in its proposed CPA before submitting again the project document for inclusion.

SECTION D. Duration of PoA

D.1. Start date of PoA

The PoA start date is set at 01/07/2012 (date of validation services contract signature with the DOE) or the date of inclusion of the first CPA, whichever is later.

D.2. Length of the PoA

The expected length of the PoA is 28 years.

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

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

Under the terms of the Environmental Impact Assessment Regulations (2010), the construction of renewable electricity generation facilities or infrastructure may be subject to:

- basic assessment when "(i) the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare", as per Activity 1 of Listing Notice 1 of the EIA regulations published in GNR 545 of 2010;

- submission of a Full Scoping and Environmental Impact Assessment (EIA) Report to the national Department of Environmental Affairs (DEA), when "(i) the electricity output is 20 megawatts or more, or (ii) the elements of the facility cover a combined area in excess of 1 hectare;" as per Activity 1 of Listing Notice 2 of the EIA regulations published in GNR 545 of 2010.

Environmental Analysis will thus be performed at CPA level according to the enforced regulations applicable in due time, given the singularity of each CPA to be included in the PoA and its presumably unique environmental impacts related to specific project context.

E.2. Analysis of the environmental impacts

Legal, Regulatory and Administrative Requirements in South Africa

The Environmental Analysis to be undertaken for each CPA will examine key relevant laws and regulatory requirements governing the construction, operation, retrofit, replacement and decommissioning of power-and-heat biomass-residue (co-)fired plants, inter alia:

- Environmental Impacts Assessment regulations, GNR 545 (2010)
- National Environmental Management Act, Act 107 (1998)
- National Environmental Management: Air Quality Act (Act No. 39 of 2004 - Solid Biomass Combustion Installations)
- National Environmental Management: Waste Act (Act No. 59 of 2008 - Section 20.b, Category B.10)
- Factories, Offices and Shops Act of 1970 (Act 328)

A summary of the analysis of the environmental impacts, including transboundary impacts and references to all related documentation will be provided at the CPA level.

E.3. Environmental impact assessment

If an environmental impact assessment is required, conclusions and references to all related documentation will be provided at the CPA level.

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

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

Stakeholder consultation will be performed at the CPA level to ensure that a wider group of stakeholders is reached since each CPA affects different geographical positions and different groups of stakeholders.

A description of the process by which comments from local stakeholders were invited and compiled will be provided at CPA level.

F.2. Summary of comments received

Identification of stakeholders and summary of comments will be provided at the CPA level.

F.3. Report on consideration of comments received

Information demonstrating that all comments received have been considered comments will be provided at the CPA level.

SECTION G. Approval and authorization

The letter of approval from Party which wishes to be involved in the PoA is not available at the time of submitting the PoA-DD to the validating DOE.

PART II. Generic component project activity (CPA)

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

CPAs to be implemented under the PoA framework consist in the implementation, replacement or retrofit of a power-and-heat plant, utilizing biomass residues (e.g. sugar cane fibre, including tops or leaves) as primary fuel.

A typical CPA, under the framework of the proposed PoA voluntarily coordinated by the CME, consists in processing biomass residue for the generation of process heat and electricity through boilers and turbo-alternators, promoting the country's biomass residues potential. Excess of electricity may be exported into the electrical distribution grid of South Africa, in line with the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme.

Each CPA will feature state-of-the-art monitoring equipment while the staff involved will be trained to properly operate, maintain and calibrate the monitoring system.

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

The approved baseline and monitoring methodology selected for to the proposed Programme of Activities is: ACM0006 "Consolidated methodology for electricity and heat generation from biomass residues" Version 12.0.1 (EB 66).

In line with the application of the ACM0006 methodology, the programme refers to the following tools:
- Tool for the demonstration and assessment of additionality (Version 06.0.0, EB65)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2, EB41)
- Emissions from solid waste disposal sites (Version 06.0.1, EB66)
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 1, EB39)
- Tool to calculate the emission factor for an electricity system (Version 02.2.1, EB63)
- Tool to determine the baseline efficiency of thermal or electricity generation systems (Version 1, EB48)
- Tool to determine the remaining lifetime of equipment (Version 01, EB50).
- Assessment of the validity of the original/current baseline and to update of the baseline at the renewal of the crediting period (Version 3.0.1, EB66)
- Project and leakage emissions from road transportation of freight (Version 01.0.0, EB63)

B.2. Application of methodology(ies)

The approved consolidated baseline and monitoring methodology ACM0006 is applicable to biomass-residue (co-)fired power-and heat plants. The typical project activity includes:

- The installation of new plants at a site where currently no power and heat generation occurs (Greenfield projects); or
- The installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects); or
- The improvement of energy efficiency of existing plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant; or
- The total or partial replacement of fossil fuels by biomass residues in existing plants or in new plants that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass residues use as compared to the baseline, by retrofitting an existing plant to use biomass residues, etc.

Table 4: *Methodology applicability conditions table*

Applicability conditions of the methodology	Applicability to the generic CPA	Evidence
(1) No biomass types other than biomass residues are used in the project plant;	By-product, residue or waste stream from agriculture, forestry and related industries are the only biomass types authorized in a typical CPA plant (e.g. sugar cane bagasse and leaves).	*Projected fuel consumptions and supply/collection agreement between the CPA implementer and biomass residues suppliers.*
(2) Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 80% of the total fuel fired on an energy basis;	No co-firing of fossil fuels in amounts exceeding 80% of total energy consumption is envisaged in a typical CPA plant (mostly start-ups and emergency use).	*Projected power and heat balance.*
(3) For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;	The implementation of a typical CPA does not result in an increase of the processing capacity of raw input or in other substantial change.	*Baseline and projected output levels (if applicable).*
(4) The biomass residues used by the project facility are not stored for more than one year;	A typical CPA does not store the biomass residues at use longer than a few months.	*Projected storage practices (if applicable).*
(5) The biomass residues used by the project facility are not obtained from chemically processed biomass (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical degradation, etc.) prior to combustion. Moreover, the preparation of biomass-derived fuel do not involve significant energy quantities, except from transportation or mechanical treatment so as not to cause significant GHG emissions;	No chemical process is involved in the biomass preparation prior to combustion in a typical CPA.	*Biomass residues supply-chain description and transformation/preparation processes details (if applicable).*

(6) In the case of fuel switch project activities, the use of biomass residues or the increase in the use of biomass residues as compared to the baseline scenario is technically not possible at the project site without a capital investment in: • The retrofit or replacement of existing heat generators/boilers; or • The installation of new heat generators/boilers; or • A new dedicated biomass residues supply chain established for the purpose of the project (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); or • Equipment for preparation and feeding of biomass residues.	In case of a typical CPA that consists in fuel switch, the use (or increase) of biomass residues compared to the baseline scenario is made technically possible by significant capital investment in retrofit, replacement or installation of heat generators/boilers, or biomass residues dedicated supply chain, preparation or feeding equipments.	*Biomass residues related capital expenditures, supply-chain description and transformation/ preparation processes details (if applicable).*
(7) In the case that biogas is used in power and/or heat generation, this methodology is applicable under the following conditions: • The biogas is generated by anaerobic digestion of wastewaster (to be) registered as a CDM project activity and the details of the registered CDM project activity must be included in the PDD. Any CERs from biogas energy generation should be claimed under the proposed project activity registered under this methodology; • The biogas is generated by anaerobic digestion of wastewater that is not (and will not) be registered as a CDM project activity. The amount of biogas does not exceed 50% of the total fuel fired on an energy basis.	Not applicable as no biogas recovery for power or heat generation is envisaged in a typical CPA.	*N/A*

Finally, the methodology is applicable since the most plausible baseline scenario to a typical CPA, as identified per the "Selection of the baseline scenario and demonstration of additionality" section hereunder, is:

- For power generation: Scenarios P2: to P7:, or a combination of any of those scenarios;
- For heat generation: Scenarios H2: to H7:, or a combination of any of those scenarios;
- If some of the heat generated by the project activity is converted to mechanical power through steam turbines, for mechanical power generation: Scenarios M2: to M5:
    - o In the case of M2 and M3, if the steam turbine(s) are used for mechanical power in the project, the turbine(s) used in the baseline shall be at least as efficient as the steam turbine(s) used for mechanical power in the project;
    - o In the case of M4 and M5, steam turbine(s) for mechanical power are not allowed for the same purpose in the project.
- For biomass residue use: Scenarios B1: to B8:, or any combination of those scenarios. For scenarios B5: to B8:, leakage emissions should be accounted for as per the procedures of the methodology.
- No use of biogas is expected under the proposed PoA thus no baseline alternatives for the biogas.

In addition to the applicability conditions of ACM0006, all the CPAs included in the PoA will also meet the applicability conditions of the following tools:

Tool for the demonstration and assessment of additionality (Version 06.0.0):
All potential alternative scenarios to the proposed project activity included in the additionality assessment and available to project participants cannot be implemented in parallel to the proposed project activity.

Tool to calculate the emission factor for an electricity system (Version 2.2.1):
This tool will be applicable for those CPAs which will import and/or export electricity of the grid.

Therefore, a typical CPA meets ACM0006 methodology requirements as reflected in the table above. It also meets the requirements of the tools mentioned above.

There is no need to provide a general description of the sampling plan in this section of the PoA as there will be no sampling plan since the CPAs to be included in the PoA are expected to be large industrial facilities uniquely designed and operated, thus individually monitored.

B.3. Sources and GHGs

Emissions sources and greenhouse gases included in each CPA boundary

According to methodology ACM0006, the spatial extent of the typical project boundary encompasses:

- All plants generating power and/or heat located at the project site, whether fired with biomass residues, fossil fuels or a combination of both;
- All power plants connected physically to the electricity system (grid) that the project plant is connected to;
- Where possible, all off-site heat sources that supply heat to the site where the project activity is located (either directly or via a district heating system);
- The means of transportation of biomass residues to the project site;
- The site where the biomass residues would have been left for decay or dumped;
- The wastewater treatment facilities used to treat the wastewater produced from the treatment of biomass residues.

Note that the typical project boundary encompasses not only the plants generating power and/or heat that are directly affected by the project activity (e.g. retrofitted or installed) but also all other plants generating power and/or heat located at the same site as the project activity, whether fired with biomass residues, fossil fuels or a combination of both. Thus power and heat generation, grid power and heat imports/exports should be considered for the whole site where the project activity is located and all facilities are to be included in the power and heat balances.

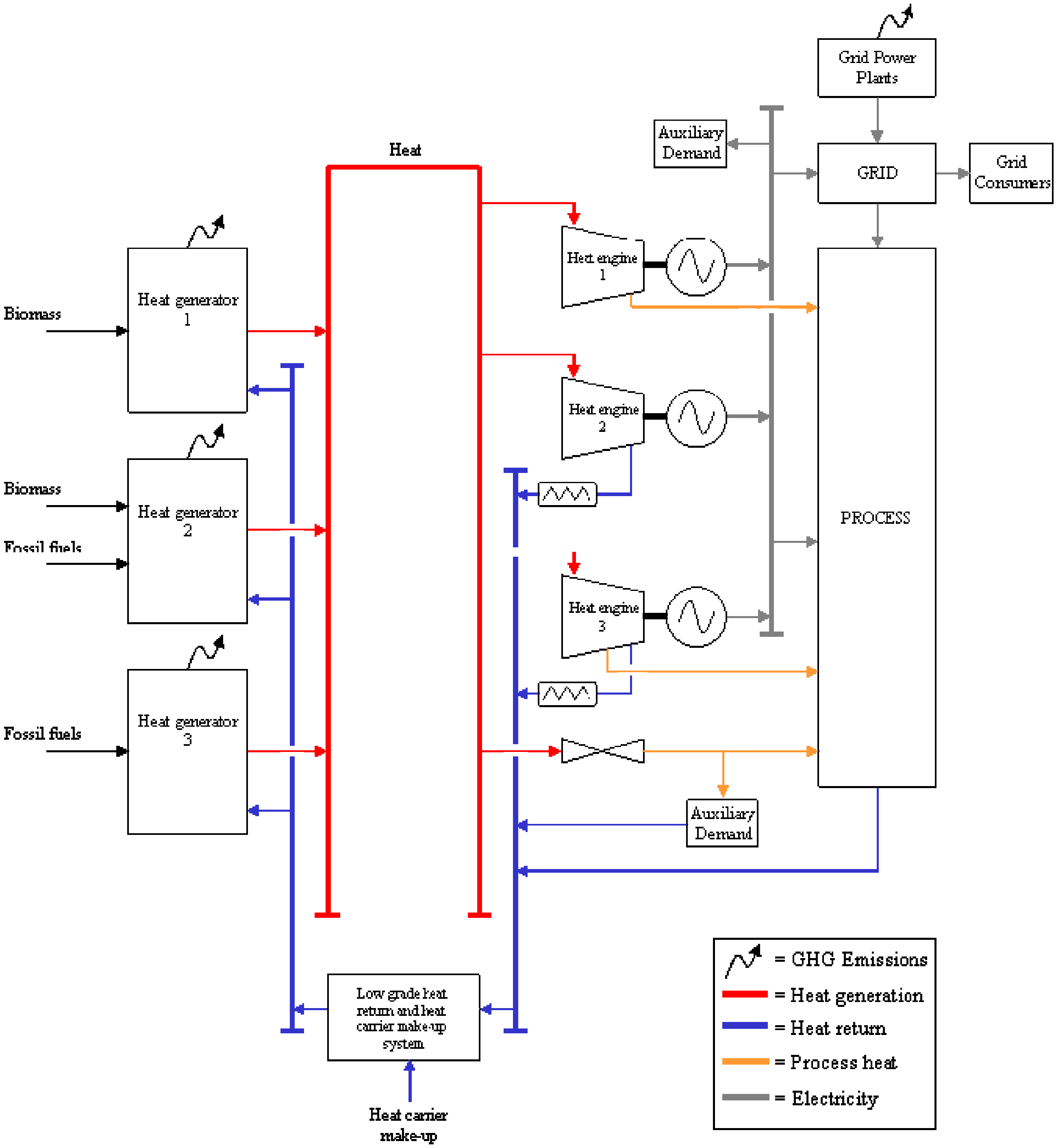
The main emission sources and type of GHGs in the project boundary are listed in the table below:

Table 5: *Gas included in the boundary related to the project activity*

Source		Gas	Included?	Justification / Explanation
Baseline	Electricity and heat generation	**CO_2**	**Included**	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative

	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	For conservativeness reasons, project participants decided not to include this emission source.
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources
Project Activity	On-site fossil fuel consumption	**CO_2**	**Included**	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass residues	**CO_2**	**Included**	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass residues for electricity and heat	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	This emission source is not included because CH_4 emissions from uncontrolled burning or decay of biomass in the baseline scenario are not included.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small
	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be very small
	Wastewater from the treatment of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	**Included or excluded**	This emission source shall be included in cases where the waste water is treated (partly) under anaerobic conditions
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small

Schematic flow diagram of a typical CPA



B.4. Description of baseline scenario

Project participant shall follow the procedure for the "Selection of the baseline scenario and demonstration of additionality" described in the methodology:

Step 1: Identification of alternative scenarios

This step serves to identify alternative scenarios to the proposed CDM project activity(s) that can be the baseline scenario through the following sub-steps:

Sub-step 1a: Definition of alternative scenarios to the proposed CDM project activity

Identify realistic alternative scenarios that are available to the project participants and that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity.

The alternative scenarios should specify:

- How electric power would be generated in the absence of the CDM project activity;
- How heat would be generated in the absence of the CDM project activity;
- If the project activity generates mechanical power through steam turbine(s): how the mechanical power would be generated in the absence of the CDM project activity; and
- What would happen to the biomass residues in the absence of the project activity.

The alternative scenarios for electric power should include, but not be limited to, *inter alia*:

P1: The proposed project activity not undertaken as a CDM project activity;

P2: If applicable,[6] the continuation of power generation in existing power plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the starting date of the project activity;

P3: If applicable,[6] the continuation of power generation in existing power plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project activity;

P4: If applicable,[6] the retrofitting of existing power plants at the project site. The retrofitting may or may not include a change in fuel mix;

P5: The installation of new power plants at the project site different from those installed under the project activity;

P6: The generation of power in specific off-site plants, excluding the power grid;

P7: The generation of power in the power grid.

The alternative scenarios for heat should include, but not be limited to, *inter alia*:

H1: The proposed project activity not undertaken as a CDM project activity;

H2: If applicable,[6] the continuation of heat generation in existing plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the project activity;

H3: If applicable,[6] the continuation of heat generation in existing plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the project activity;

H4: If applicable,[6] the retrofitting of existing plants at the project site. The retrofitting may or may not include a change in fuel mix;

H5: The installation of new plants at the project site different from those installed under the project activity;

H6: The generation of heat in specific off-site plants;

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[6] This alternative is only applicable if there are existing plants operating at the project site.

H7: The production of heat from district heating.

The alternative scenarios for mechanical power should include, but not be limited to, *inter alia*:

M1: The proposed project activity not undertaken as a CDM project activity;

M2: If applicable, the continuation of mechanical power generation from the same steam turbines in existing plants at the project site;

M3: The installation of new steam turbines at the project site;

M4: If applicable, the continuation of mechanical power generation from electrical motors in existing plants at the project site;

M5: The installation of new electrical motors at the project site.

For the use of biomass residues, the alternative scenarios should include, but not be limited to, *inter alia*:

B1: The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields;

B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;

B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes;

B4: The biomass residues are used for power or heat generation at the project site in new and/or existing plants;

B5: The biomass residues are used for power or heat generation at other sites in new and/or existing plants;

B6: The biomass residues are used for other energy purposes, such as the generation of biofuels;

B7: The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry);

B8: Biomass residues are purchased from a market, or biomass residues retailers, or the primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.

Outcome of Sub-step 1a: *List of plausible alternative scenarios to the project activity.*

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

The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution.[7] This sub-step does not consider national and local policies that do not have legally-binding status.

If an alternative does not comply with all mandatory legislation and regulations applicable in the geographical area, then show based on an examination of current practice in the geographical area, that those applicable mandatory legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread. If this cannot be shown, then eliminate the alternative from further consideration.

[7] For example, an alternative would be non-complying in a country where this scenario would imply violations of safety or environmental regulations.

If the proposed CDM project activity is the only alternative that is in compliance with all mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Outcome of Sub-step 1b: *List of alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country.*

Proceed to Step 2 (Barrier analysis) or to Step 3 (Investment analysis)

Step 2: Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. Apply the following sub-steps:

Sub-step 2a: Identify barriers that would prevent the implementation of alternative scenarios

Establish a complete list of realistic and credible barriers that may prevent alternative scenarios to occur. Such realistic and credible barriers may include:

- Investment barriers, other than insufficient financial returns as analyzed in Step 3, *inter alia*:
    - For alternatives undertaken and operated by private entities: Similar activities have only been implemented with grants or other non-commercial finance terms. Similar activities are defined as activities that rely on a broadly similar technology or practices, are of a similar scale, take place in a comparable environment with respect to regulatory framework and are undertaken in the relevant geographical area, as defined in Sub-step 1a above;
- No private capital is available from domestic or international capital markets due to real or perceived risks associated with investments in the country and/or sector and/or technology where the CDM project activity is to be implemented, as demonstrated by the credit rating of the country and/or sector and/or technology or other country and/or sector and/or technology investment reports of reputed origin. Technological barriers, *inter alia*:
    - Skilled and/or properly trained labour to operate and maintain the equipment is not available in the relevant geographical area, which leads to an unacceptably high risk of equipment disrepair, malfunctioning or other underperformance
    - Lack of infrastructure for implementation and logistics for maintenance of the equipment (e.g. natural gas cannot be used because of the lack of a gas transmission and distribution network);
    - Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information;
    - The particular technology used in the proposed CDM project activity is not available in the relevant geographical area.
- Lack of prevailing practice:
    - The alternative is the “first of its kind”.

Outcome of Step 2a: *List of barriers that may prevent one or more alternative scenarios to occur.*

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

Identify which alternative scenarios are prevented by at least one of the barriers listed in Sub-step 2a, and eliminate those alternative scenarios from further consideration. All alternative scenarios shall be compared to the same set of barriers. The assessment of the significance of barriers should take into account the level of access to and availability of information, technologies and skilled labour in the specific context of the industry where the project type is located. For example, projects located in sectors with small and medium sized enterprises may not have the same means to overcome technological barriers as projects in a sector where typically large or international companies operate. A description of the environment where the CDM project activity is inserted should be included in the CDM-PDD.

Outcome of Sub-step 2b: *List of alternative scenarios to the CDM project activity that are not prevented by any barrier.*

Outcome of Step 2: If there is only one alternative scenario that is not prevented by any barrier, and if this alternative is the proposed project activity undertaken without being registered as a CDM project activity, then the project activity is not additional.

If there is only one alternative scenario that is not prevented by any barrier, and if this alternative is not the proposed project activity undertaken without being registered as a CDM project activity, then this alternative scenario is identified as the baseline scenario. Explain – using qualitative or quantitative arguments – how the registration of the CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM. If the CDM alleviates the identified barriers that prevent the proposed project activity from occurring, proceed to Step 4, otherwise the project activity is not additional.

If there are still several alternative scenarios remaining, including the proposed project activity undertaken without being registered as a CDM project activity, proceed to Step 3 (investment analysis).

If there are still several alternative scenarios remaining, but which do not include the proposed project activity undertaken without being registered as a CDM project activity, explain – using qualitative or quantitative arguments – how the registration of the CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM. If the CDM alleviates the identified barriers that prevent the proposed project activity from occurring, project participants may choose to either:

- Option 1: Go to Step 3 (investment analysis); or
- Option 2: Identify the alternative with the lowest emissions[8] (i.e. the most conservative) as the baseline scenario, and proceed to Step 4.

If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.

Step 3: Investment analysis

The objective of Step 3 is to compare the economic or financial attractiveness of the alternative scenarios by conducting an investment analysis. The analysis should include all alternative scenarios (or in case that Step 2 is conducted, the remaining alternative scenarios after Step 2), including scenarios where the project participants do not undertake an investment (e.g. a combination of B1: and P7:).

This step should be implemented following the guidance provided in Step 2 of the latest version of the "Tool for the demonstration and assessment of additionality", so as to determine whether the proposed project activity is not:

[8] The respective emissions should be determined in accordance with the procedures in this methodology.

(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

The latest version of the *Guidelines on the assessment of investment analysis*, available on the UNFCCC website, shall be taken into account when applying this step.

Outcome of Step 3: *Ranking of the short list of alternative scenarios according to the most suitable financial indicator, taking into account the results of the sensitivity analysis.*

If the investment analysis, supported by the sensitivity analysis, is not conclusive, then the alternative scenario to the project activity with least emissions among the alternative scenarios is considered as baseline scenario. If the investment analysis, supported by the sensitivity analysis, is conclusive, then the most economically or financially attractive alternative scenario is considered as baseline scenario. If the alternative considered as baseline scenario is the "proposed project activity undertaken without being registered as a CDM project activity", then the project activity is not additional. Otherwise, proceed to Step 4.

Step 4: Common practice analysis

The previous steps shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and geographical area. This test is a credibility check to demonstrate additionality which complements, where applicable, the barrier analysis (Step 2) and, where applicable, the investment analysis (Step 3).

Provide an analysis to which extent similar activities to the proposed CDM project activity have been implemented previously or are currently underway. Similar activities are defined as activities (i.e. technologies or practices) that are of similar scale, take place in a comparable environment, *inter alia*, with respect to the regulatory framework and are undertaken in the relevant geographical area, as defined in Sub-step 1a above. Other registered CDM project activities are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant geographical area.

If similar activities to the proposed project activity are identified, then compare the proposed project activity to the other similar activities and assess whether there are essential distinctions between the proposed project activity and the similar activities. If this is the case, point out and explain the essential distinctions between the proposed project activity and the similar activities and explain why the similar activities enjoyed certain benefits that rendered them financially attractive (e.g. subsidies or other financial flows) and which the proposed project activity cannot use or why the similar activities did not face barriers to which the proposed project activity is subject.

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

Outcome of Step 4: *If Step 4 is satisfied, i.e. (i) similar activities cannot be observed or (ii) similar activities are observed but essential distinctions between the proposed CDM project activity and similar activities can reasonably be explained, then the proposed project activity is* <u>*additional*</u>.

If Step 4 is not satisfied, i.e. similar activities can be observed and essential distinctions between the proposed CDM project activity and similar activities cannot reasonably be explained, then the proposed CDM project activity is not additional.

B.5. Demonstration of eligibility for a generic CPA

Eligibility criteria		
Category	**N°**	**Description**
Boundary and location of the CPA	1	**The geographical boundary of the CPA is within the Republic of South Africa, in consistence with the geographical boundary set in the PoA.** **How each generic CPA meets the eligibility criteria?** Location and boundary are stated in the specific CPA-DD, confirming that the industrial facility is located in South Africa. **Mean of proof / Evidence Document:** GPS coordinates **Assessment:** ☐Yes ☐No
Double counting avoidance	2.1	**The CPA is neither already included in another PoA or bundled CDM project activity, nor developed as a stand-alone CDM project.** **How each generic CPA meets the eligibility criteria?** The CPA implementer confirms that the CPA is not already included in another PoA or developed as a stand-alone CDM project. **Mean of proof / Evidence Document:** The "Procedure to avoid double-counting" formulated in the PoA-DD is applied and the assessment is conclusive. **Assessment:** ☐Yes ☐No
	2.2	**The industrial facility included in the CPA is uniquely identified.** **How each generic CPA meets the eligibility criteria?** The CPA implementer confirms that it will uniquely mark the project facility and publicly indicate it is part of the PoA at project commissioning or at CPA inclusion, whichever is later. **Mean of proof / Evidence Document:** GPS location and/or serial number and/or distinctive plate. **Assessment:** ☐Yes ☐No
	2.3	**The CPA is either implemented by the CME or by another entity acknowledging its participation in the PoA with an agreement in place that transfers the emission reductions title to the CME.** **How each generic CPA meets the eligibility criteria?** The CPA implementer shall sign a binding agreement with the CME, which ensures that CPA implementer is aware and agrees that its carbon rights have to be relinquished to CME. **Mean of proof / Evidence Document:** Binding agreement signed between the CPA implementer and the CME. **Assessment:** ☐Yes ☐No
Technology/measure specifications	3.1	**The CPA-DD specifies the level and type of service provided by the technology/measure, as well as its performance.** **How each generic CPA meets the eligibility criteria?** The technology and measures taken are clearly described in the CPA-DD and in line with the technology definition in the PoA-DD. **Mean of proof / Evidence Document:**

		Technology provider contractual specifications **Assessment:** ☐Yes ☐No
	3.2	**The technology/measure implemented within the CPA complies with national and/or international testing/certification requirements.**
		How each generic CPA meets the eligibility criteria? The CPA implementer meets applicable testing or certification standard in the industry and at national level. **Mean of proof / Evidence Document:** Applicable testing or certification standard reference documents and proof of compliance **Assessment:** ☐Yes ☐No
CPA start date	4	**The starting date of the CPA is verifiable through documentary evidence and is not prior to the start of PoA validation.**
		How each generic CPA meets the eligibility criteria? The CPA-DD determines the start date based on implementation, construction or real action start. **Mean of proof / Evidence Document:** Supporting documentary evidence for the starting date is provided. **Assessment:** ☐Yes ☐No
Crediting period	5	**The crediting period of the CPA shall not exceed the length of the PoA (i.e. 28 years) regardless of the time of inclusion of CPA in the PoA.**
		How each generic CPA meets the eligibility criteria? The CPA-DD verifies that the crediting period of the CPA does not exceed the length of the PoA. **Mean of proof / Evidence Document:** CPA implementer's statement and chosen crediting period **Assessment:** ☐Yes ☐No
Compliance and application of the methodology ACM0006	6	**The proposed CPA meets the applicability criteria and other requirements of the latest version of ACM0006 as outlined in section II.B.2. of the PoA-DD.**
		How each generic CPA meets the eligibility criteria? The CPA-DD shall demonstrate in its section D.2 that all applicability criteria and requirements of ACM0006 methodology are verified. **Mean of proof / Evidence Document:** Applicability conditions' related evidence **Assessment:** ☐Yes ☐No
CPA additionality	7	**The CPA is additional, in compliance with the relevant requirements pertaining to the demonstration of additionality as outlined in section II.B.4. of the PoA-DD.**
		How each generic CPA meets the eligibility criteria? The CPA successfully applies in its section D.4 the step-by-step additionality demonstration of ACM0006 methodology. **Mean of proof / Evidence Document:** Additionality demonstration related analysis and supporting evidence. **Assessment:** ☐Yes ☐No
Undertaking of local stakeholder	8.1	**A local stakeholder consultation has been conducted prior to the inclusion of the CPA.**

consultations and environmental impact analysis		**How each generic CPA meets the eligibility criteria?** The CPA-DD details the proceedings of the stakeholder consultation in its section C. **Mean of proof / Evidence Document:** Stakeholder consultation attendance sheet and comments. **Assessment:** ☐Yes ☐No
	8.2	**If applicable, an environmental impact analysis has been conducted prior to the inclusion of the CPA.**
		How each generic CPA meets the eligibility criteria? The CPA-DD outlines the EIA requirements and provides details on the EIA process/outcome in its section B. **Mean of proof / Evidence Document:** EIA report and/or Environmental license. **Assessment:** ☐Yes ☐No ☐ Inapplicable
Non-diversion of ODA in case of Public funding	9	**Confirmation that the CPA does not involve any public funding from Annex I Parties or that in case public funding is used, it does not result in diversion of Official Development Assistance (ODA)**
		How each generic CPA meets the eligibility criteria? The CPA-DD confirms that the CPA does not involve any public funding or that in case public funding is used a confirmation that official development assistance is not being diverted to the implementation of the PoA. **Mean of proof / Evidence Document:** Letter from the CPA implementer confirming No diversion of ODA in case of public funding. **Assessment:** ☐Yes ☐No
Approval of CPA by the CME before submission	10	**The CPA-DD has been reviewed by the CME and submitted to a DOE for inclusion into the PoA.**
		How each generic CPA meets the eligibility criteria? The CPA implementer shall submit a CPA-DD to the CME with all underlying evidence for review. If the conclusion of CME review is positive, the CME shall notify the CPA implementer of the submission of the CPA-DD to the DOE for inclusion. Otherwise conclusion of the CME review shall be sent to the CPA implementer **Mean of proof / Evidence Document:** Technical review report drafted by the CME review team. **Assessment:** ☐Yes ☐No

The CPA Inclusion Procedure that encompasses all provisions and procedures related to pre-inclusion due diligence has been used as the foundation of compliance team activities. The compliance report is available to the DOE.

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

The following equations are used to calculate emission reductions, baseline emissions, project emissions and leakage of the CPA:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(1)}$$

Where:

ER_y	=	Emissions reductions in year *y* (tCO_2)
BE_y	=	Baseline emissions in year *y* (tCO_2)
PE_y	=	Project emissions in year *y* (tCO_2)
LE_y	=	Leakage emissions in year *y* (tCO_2)

Baseline Emissions

$$BE_y = EL_{BL,GR,y} \cdot EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \cdot EF_{FF,y,f} + EL_{BL,FF/GR,y} \cdot \min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y} \tag{2}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EL_{BL,GR,y}$	=	Baseline minimum electricity generation in the grid in year *y* (MWh)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
$FF_{BL,HG,y,f}$	=	Baseline fossil fuel demand for process heat in year *y* (GJ)
$EF_{FF,y,f}$	=	CO_2 emission factor for fossil fuel type f in year *y* (tCO_2/GJ)
$EL_{BL,FF/GR,y}$	=	Baseline uncertain electricity generation in the grid or on-site in year *y* (MWh)
$EF_{EG,FF,y}$	=	CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year *y* (tCO_2/MWh)
$BE_{BR,y}$	=	Baseline emissions due to disposal of biomass residues in year *y* (tCO2e)
y	=	Year of the crediting period
f	=	Fossil fuel type

Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors in the baseline

Step 1.1: Determine total baseline process heat generation

The amount of process heat that would be generated in the baseline in year *y* ($HC_{BL,y}$) is determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. The process heat should be calculated net of any parasitic heat used for drying of biomass.

This methodology assumes for the sake of simplicity that the proposed CDM project activity consumes steam from the same quality as in baseline process transported through one steam header.

Step 1.2: Determine total baseline electricity generation

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y} \tag{3}$$

Where:

$EL_{BL,y}$	=	Baseline electricity generation in year *y* (MWh)

$EL_{PJ,gross,y}$	=	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y* (MWh)
$EL_{PJ,imp,y}$	=	Project electricity imports from the grid in year *y* (MWh)
$EL_{PJ,aux,y}$	=	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year *y* (MWh)
y	=	Year of the crediting period

$EL_{PJ,aux,y}$ includes all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power or heat generating plants which are located at the project site and included in the project boundary (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.).

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity and are therefore not accounted for.

Step 1.3: Determine baseline capacity of electricity generation

The total capacity of electricity generation available in the baseline should be calculated using the equation below. The heat engines *i* and *j* should be obtained from the baseline scenario identified using the "Selection of the baseline scenario and demonstration of additionality" and the load factors should take into account seasonal operational constraints as well as other technical constraints in the system (e.g. availability of heat to drive heat engines).

$$CAP_{EG,total,y} = LOC_y \cdot \left[\sum_i \left(CAP_{EG,CG,i} \cdot LFC_{EG,CG,i} \right) + \sum_j \left(CAP_{EG,PO,j} \cdot LFC_{EG,PO,j} \right) \right] \quad \textbf{(4)}$$

Where:

$CAP_{EG,total,y}$	=	Baseline electricity generation capacity in year *y* (MWh)
$CAP_{EG,CG,i}$	=	Baseline electricity generation capacity of heat engine *i* (MW)
$CAP_{EG,PO,j}$	=	Baseline electricity generation capacity of heat engine *j* (MW)
$LFC_{EG,CG,i}$	=	Baseline load factor of heat engine *i* (ratio)
$LFC_{EG,PO,j}$	=	Baseline load factor of heat engine *j* (ratio)
LOC_y	=	Length of the operational campaign in year *y* (hour)
i	=	Cogeneration-type heat engine in the baseline scenario
j	=	Power-only-type heat engine in the baseline scenario
y	=	Year of the crediting period

Step 1.4: Determine the baseline availability of biomass residues

Where the baseline scenario includes the use of biomass residues for the generation of power and/or heat, the amount of biomass residues of category *n* that would be available in the baseline in year *y* ($BR_{B4,n,y}$) has to be determined.

The determination of this parameter shall be based on the monitored amounts of biomass residues used for power and/or heat generation in the project boundary for which B4: or BG3 has been identified as the most plausible baseline scenario in the CDM-PDD (as per Step B.4 above). The biomass residues quantities used should be monitored separately for (a) each type of biomass residue (e.g. sugarcane bagasse, rice husks, empty fruit bunches, etc.) and each source (e.g. produced on-site, obtained from biomass residues suppliers, obtained from a biomass residues market, obtained from an identified biomass residues producer, etc.).

Step 1.1: Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines

The efficiencies of heat generators and heat engines should be calculated using one of the following options:

Option 1: **Default values.** Use Option F in the latest approved version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems".[9]

The default value for the losses linked to the electricity generator group (i.e. turbine/engine, couplings and electricity generator), $GGL_{default}$, is 5%.

Option 2: **Manufacturer's data.** This option is only applicable to heat engines and heat generators that were operated at the project site prior to the implementation of the project activity (and not new equipment that would be constructed and operated at the project site in the baseline scenario). The efficiency of the heat generator or heat engine is determined based on manufacturer's data of the efficiency under optimal operating conditions and take into account the actual conditions of the fuel used (including moisture content of biomass residues).

Option 3: This option is only applicable to heat generators and heat engines that were operated at the project site for at least three calendar years prior the date of submission of the PDD for validation of the project activity. The efficiencies of heat generators and heat engines are determined based on the historical records, as follows:

Efficiency for heat generators

The efficiency for heat generators should be calculated using the following equation:

$$\eta_{BL,HG,BR,h} = MAX\left\{\frac{HG_{BR,h,x}}{\sum_{n} BR_{n,h,x} \cdot NCV_{BR,n,x}}; \frac{HG_{BR,h,x-1}}{\sum_{n} BR_{n,h,x-1} \cdot NCV_{BR,n,x-1}}; \frac{HG_{BR,h,x-2}}{\sum_{n} BR_{n,h,x-2} \cdot NCV_{BR,n,x-2}}\right\} \quad (5)$$

$$\eta_{BL,HG,FF,h} = MAX\left\{\frac{HG_{FF,h,x}}{\sum_{n} FF_{f,h,x} \cdot NCV_{FF,f,x}}; \frac{HG_{FF,h,x-1}}{\sum_{n} FF_{f,h,x-1} \cdot NCV_{FF,f,x-1}}; \frac{HG_{FF,h,x-2}}{\sum_{n} FF_{f,h,x-2} \cdot NCV_{FF,f,x-2}}\right\} \quad (6)$$

Where:

$\eta_{BL,HG,BR,h}$	=	Baseline biomass-based heat generation efficiency of heat generator *h* (ratio)
$\eta_{BL,HG,FF,h}$	=	Baseline fossil-based heat generation efficiency of heat generator *h* (ratio)
$HG_{BR,h,x}$	=	Net quantity of heat generated from using biomass residues in heat generator *h* in year *x* (GJ/yr)
$HG_{FF,h,x}$	=	Net quantity of heat generated from using fossil fuels in heat generator *h* in year *x* (GJ/yr)
$BR_{n,h,x}$	=	Quantity of biomass residues of category n used in heat generator *h* in year *x* (tonnes on dry-basis)
$FF_{f,h,x}$	=	Quantity of fossil fuel type f fired in heat generator *h* in year *x*

[9] Where a default value is not provided for a technology a request for revision to this methodology may be submitted.

		(mass or volume unit/yr)
$NCV_{BR,n,x}$	=	Net calorific value of biomass residues of category *n* in year *x* (GJ/tonnes on dry-basis)
$NCV_{FF,f,x}$	=	Net calorific value of fossil fuel type *f* in year *x* (GJ/mass or volume unit)
x	=	Last calendar year prior to the start of the crediting period
n	=	Biomass residue category
f	=	Fossil fuel type
h	=	Heat generator in the baseline scenario

If fossil fuels and biomass residues were used for heat generation in the heat generator h prior to the implementation of the project activity, then $HG_{BR,h,x}$, $HG_{BR,h,x-1}$ and $HG_{BR,h,x-2}$, as well as $HG_{FF,h,x}$, $HG_{FF,h,x-1}$ and $HG_{FF,h,x-2}$, are determined as follows:

$$HG_{BR,h,x} = HG_{h,x} \cdot \frac{\sum_{n} BR_{n,h,x} \cdot NCV_{BR,n,x}}{\sum_{n} BR_{n,h,x} \cdot NCV_{BR,n,x} + \sum_{f} FF_{f,h,x} \cdot NCV_{FF,f,x}} \quad \textbf{(7)}$$

$$HG_{FF,h,x} = HG_{h,x} \cdot \frac{\sum_{n} FF_{f,h,x} \cdot NCV_{FF,f,x}}{\sum_{n} BR_{n,h,x} \cdot NCV_{BR,n,x} + \sum_{f} FF_{f,h,x} \cdot NCV_{FF,f,x}} \quad \textbf{(8)}$$

Where:

$HG_{BR,h,x}$	=	Net quantity of heat generated from using biomass residues in heat generator *h* in year *x* (GJ/yr)
$HG_{FF,h,x}$	=	Net quantity of heat generated from using fossil fuels in heat generator *h* in year *x* (GJ/yr)
$HG_{h,x}$	=	Net quantity of heat generated in heat generator *h* in year x (GJ/yr)
$BR_{n,h,x}$	=	Quantity of biomass residues of category *n* used in heat generator *h* in year *x* (tonnes on dry-basis)
$FF_{f,h,x}$	=	Quantity of fossil fuel type *f* fired in heat generator *h* in year *x* (mass or volume unit/yr)
$NCV_{BR,n,x}$	=	Net calorific value of biomass residues of category *n* in year *x* (GJ/tonnes on dry-basis)
$NCV_{FF,f,x}$	=	Net calorific value of fossil fuel type *f* in year *x* (GJ/mass or volume unit)

Efficiency for heat engines

The efficiency for heat engines should be calculated using the following equation:

$$\eta_{BL,EG,PO,i/j} = MAX\left\{\frac{EL_{BR,PO,x,i/j}}{HG_{BR,PO,x,i/j}};\frac{EL_{BR,PO,x-1,i/j}}{HG_{BR,PO,x-1,i/j}};\frac{EL_{BR,PO,x-2,i/j}}{HG_{BR,PO,x-2,i/j}}\right\} \quad \textbf{(9)}$$

Where:

$\eta_{BL,EG,CG,i}$	=	Baseline electricity generation efficiency of heat engine *i* (MWh/GJ)
$\eta_{BL,EG,PO,j}$	=	Average electric power generation efficiency of heat engine *j*

		(MWh/GJ)
$EL_{BR,CG/PO,x,i/j}$	=	Quantity of electricity generated in heat engine *i/j* in year *x* (MWh)
$HG_{BR,CG/PO,x,i/j}$	=	Quantity of heat used in heat engine *i/j* in year *x* (GJ)
x	=	Last calendar year prior to the start of the crediting period
i	=	Cogeneration-type heat engine in the baseline scenario
j	=	Power-only-type heat engine in the baseline scenario

The heat-to-power ratio of cogeneration-type heat engines (e.g. backpressure and heat-extraction steam turbines) should be calculated as follows.

Case 1: For existing heat engines with a minimum three-year operational history prior to the project activity:

$$HPR_{BL,EG,CG/PO,i/j} = \frac{1}{3.6} \cdot MAX\left\{\frac{HC_{BR,CG/PO,x,i/j}}{EL_{BR,CG/PO,x,i/j}}; \frac{HC_{BR,CG/PO,x-1,i/j}}{EL_{BR,CG/PO,x-1,i/j}}; \frac{HC_{BR,CG/PO,x-2,i/j}}{EL_{BR,CG/PO,x-2,i/j}}\right\} \quad (10)$$

Where:

$HPR_{BL,i}$	=	Baseline heat-to-power ratio of the heat engine *i* (ratio)
$HC_{BR,CG/PO,x,i/j}$	=	Quantity of process heat extracted from the heat engine *i/j* in year *x* (GJ)
$EL_{BR,CG/PO,x,i/j}$	=	Quantity of electricity generated in heat engine *i/j* in year *x* (MWh)
x	=	Last calendar year prior to the start of the crediting period
i	=	Cogeneration-type heat engine in the baseline scenario
j	=	Power-only-type heat engine in the baseline scenario

Case 2: For heat engines without a minimum three-year operational history prior to the project activity the heat-to-power ratio should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario in the "Selection of the baseline scenario and demonstration of additionality".

Step 1.2: Determine the emission factor of on-site electricity generation with fossil fuels

If no fossil fuel based power generation was identified as part of the baseline scenario, or if fossil fuel based power generation was identified as part of the baseline scenario, but all capacity of power generation based on fossil fuels is used in the cogeneration mode (i.e. up to step 4.2) , then make $EF_{EG,FF,y} = EF_{EG,GR,y}$.

Otherwise, i.e. fossil fuel based power generation was identified as part of the baseline scenario and after conducting the steps up to 4.2 some power generation capacity based on fossil fuels is left, $EF_{EG,FF,y}$ should be determined using Option A or Option B below. If fossil fuel power plants were operated at the project site prior to the implementation of the project activity, either Option A or Option B can be used. For new power plants that would be constructed at the project site in the baseline scenario, Option B should be used.

Option A: Determine $EF_{EG,FF,y}$ as per the procedure described under "Scenario B: Electricity consumption from an off-grid captive power plant" in the latest approved version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", using data from the three calendar years prior the date of submission of the PDD for validation of the project activity.

Option B: Determine a default emission factor for $EF_{EG,FF}$ based on a default efficiency of the power plant that would be operated at the project site in the baseline and a default CO_2 emission factor for the fossil fuel types that would be used, as follows:

$$EF_{EG,FF} = 3.6 \cdot \frac{EF_{BL,CO2,FF}}{\eta_{BL,FF}} \quad \textbf{(11)}$$

Where:

$EF_{EG,FF,y}$	=	CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y (tCO_2/MWh)
$EF_{BL,CO2,FF}$	=	CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline (tCO_2/GJ)
$\eta_{BL,FF}$	=	Efficiency of the fossil fuel power plant(s) at the project site in the baseline (ratio)

Step 1.3: Determine the emission factor of grid electricity generation

The parameter $EF_{EG,GR,y}$ should be determined as the combined margin CO_2 emission factor for grid to which the project activity is connected in year *y*, calculated using the latest approved version of the "Tool to calculate the emission factor for an electricity system".

Step 1: Determine the minimum baseline electricity generation in the grid

The calculation of the minimum amount of electricity that would be generated in the grid in the baseline is based on the assumption that the amount of electricity generated on-site in the baseline cannot be higher than the installed capacity of power generation available in the baseline scenario. Therefore, the following equation should be used:

$$EL_{BL,GR,y} = \max\left(0, EL_{BL,y} - CAP_{EG,total,y}\right) \quad \textbf{(12)}$$

Where:

$EL_{BL,GR,y}$	=	Baseline minimum electricity generation in the grid in year *y* (MWh)
$EL_{BL,y}$	=	Baseline electricity generation in year *y* (MWh)
$CAP_{EG,total,y}$	=	Baseline electricity generation capacity in year *y* (MWh)
y	=	Year of the crediting period

For baseline alternatives not connected to the grid or otherwise technically or legally impossible to export power to the grid $EL_{BL,GR,y} = 0$.

Step 2: Determine the baseline biomass-based heat and power generation

Step 3.1: Determine the baseline biomass-based heat generation

It is assumed that the use of biomass residues for which scenario B4: has been identified as the baseline scenario ($BR_{B4,n,y}$) would be prioritized over the use of any fossil fuels in the baseline. From that assumption, the equivalent amount of heat that would be generated with biomass residues ($HG_{BL,BR,y}$) should be determined.

$$HG_{BL,BR,y} = \sum_h \sum_n \left(BR_{B4,n,h,y} \cdot NCV_{BR,n,y} \cdot \eta_{BL,HG,BR,h}\right) \quad \textbf{(13)}$$

Subject to,

$\sum_h \sum_n BR_{B4,n,h,y} = \sum_n BR_{B4,n,y}$, i.e. the biomass residues used in each heat generator should not exceed the total amount of biomass residues available. **(14)**

$\sum_n \left(BR_{B4,n,h,y} \cdot NCV_{BR,n,y} \cdot \eta_{BL,HG,BR,h} \right) \leq LOC_y \cdot CAP_{HG,h} \cdot LFC_{HG,h}$, i.e. the heat generation in each heat generator should not exceed the total capacity of the heat generator; **(15)**

Where:

$HG_{BL,BR,y}$	=	Baseline biomass-based heat generation in year *y* (GJ)
$BR_{B4,n,h,y}$	=	Quantity of biomass residues of category n used in heat generator h in year *y* with baseline scenario B4 (tonne on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category n in year *y* (GJ/tonne on dry-basis)
$\eta_{BL,HG,BR,h}$	=	Baseline biomass-based heat generation efficiency of heat generator *h* (ratio)
$BR_{B4,n,y}$	=	Quantity of biomass residues of category n used in the project activity in year *y* for which the baseline scenario is B4: (tonne on dry-basis)
LOC_y	=	Length of the operational campaign in year *y* (hour)
$CAP_{HG,h}$	=	Baseline capacity of heat generator *h* (GJ/h)
$LFC_{HG,h}$	=	Baseline load factor of heat generator *h* (ratio)
y	=	Year of the crediting period
h	=	Heat generator in the baseline scenario

Step 3.2: Determine the baseline biomass-based cogeneration of process heat and electricity and heat extraction

It is assumed that cogeneration of process heat and power using biomass-based heat ($HG_{BL,BR,y}$) would be prioritized over the use of fossil fuels for the generation of process heat and power on-site. From that assumption the equivalent amount of electricity ($EL_{BL,BR,CG,y}$) and process heat ($HC_{BL,BR,CG,y}$) that would be generated are determined.

$$EL_{BL,BR,CG,y} = \frac{1}{3.6} \cdot \sum_i \left(\frac{1}{(HPR_{BL,i} + 1 + GGL_{default})} \cdot HG_{BL,BR,CG,y,i} \right) \qquad \textbf{(16)}$$

$$HC_{BL,BR,CG,y} = \sum_i \left(\frac{HPR_{BL,i}}{(HPR_{BL,i} + 1 + GGL_{default})} \cdot HG_{BL,BR,CG,y,i} \right) \qquad \textbf{(17)}$$

Subject to,

$\sum_i HG_{BL,BR,CG,y,i} \leq HG_{BL,BR,y}$, i.e. the biomass-based heat used in cogeneration mode should not exceed the total biomass-based heat generated; **(18)**

$HC_{BL,BR,CG,y} \leq HC_{BL,y}$, i.e. the process heat cogenerated should not exceed the total process heat demand; **(19)**

$\left(\eta_{BL,EG,CG,i} \cdot HG_{BL,BR,CG,y,i} \right) \leq LOC_y \cdot CAP_{EG,CG,i} \cdot LFC_{EG,CG,i}$, i.e. the electricity generation in each heat engine should not exceed the total capacity of the heat engine. **(20)**

Where:

$EL_{BL,BR,CG,y}$	=	Baseline biomass-based cogenerated electricity in year *y* (MWh)
$\eta_{BL,EG,CG,i}$	=	Baseline electricity generation efficiency of heat engine *i* (MWh/GJ)

$HG_{BL,BR,CG,y,i}$	=	Baseline biomass-based heat used in heat engine *i* in year *y* (GJ)
$HC_{BL,BR,CG,y}$	=	Baseline biomass-based process heat cogenerated in year *y* (GJ)
$HPR_{BL,i}$	=	Baseline heat-to-power ratio of the heat engine *i* (ratio)
$GGL_{default}$	=	The default value for the losses linked to the electricity generator group (turbine, couplings and electricity generator. Set at 0.05) (ratio)
$HG_{BL,BR,y}$	=	Baseline biomass-based heat generation in year *y* (GJ)
$HC_{BL,y}$	=	Baseline process heat generation in year *y* (GJ)
LOC_y	=	Length of the operational campaign in year *y* (hour)
$CAP_{EG,CG,i}$	=	Baseline electricity generation capacity of heat engine *i* (MW)
$LFC_{EG,CG,i}$	=	Baseline load factor of heat engine *i* (ratio)
i	=	Cogeneration-type heat engine in the baseline scenario
y	=	Year of the crediting period

The next step to be followed depends on the outcomes of the calculations above. Four cases are possible:

Case 3.2.1: If $HG_{BL,BR,y} = \sum_i HG_{BL,BR,CG,y,i}$ and $HC_{BL,y} = HC_{BL,BR,CG,y}$, then all the heat that would be generated using biomass residues in the baseline would be used in cogeneration-type heat engines and would suffice to serve all process heat demand. It is assumed then that the use of fossil fuels on-site in the baseline scenario would be uncertain (except for the amount required due to technical constraints) because it would depend on a number of factors that are not taken into account in this methodology, particularly on the relative prices of on-site electricity generation using fossil fuels and the electricity price in the grid. In order to estimate the baseline parameters that result project participants should:

- Define $EL_{BL,FF/GR,y} = EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$, $EL_{PJ,offset,y} = 0$, $FF_{BL,HG,y,f} = 0$, and,
- Proceed to Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Case 3.2.2: If $HG_{BL,BR,y} = \sum_i HG_{BL,BR,CG,y,i}$ and $HC_{BL,y} > HC_{BL,BR,CG,y}$, then all the heat that would be generated using biomass residues in the baseline would be used in cogeneration-type heat engines but still some process heat demand would remain to be met. It is assumed then that the process heat balance that remains to be met would be met by using fossil fuels. In order to estimate the baseline parameters that result, project participants should:

- Define $HC_{balance,FF,y} = HC_{BL,y} - HC_{BL,BR,CG,y}$,
  $EL_{balance,FF,y} = EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$, and,
- Proceed to Step 3: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation.

Case 3.2.3: If $HG_{BL,BR,y} > \sum_i HG_{BL,BR,CG,y,i}$ and $HC_{BL,y} = HC_{BL,BR,CG,y}$, then all process heat demand would be met with biomass-based heat in the baseline and still there would be some biomass-based heat to be used. It is assumed then that this heat would be used for generation of power in power-only mode, i.e. without cogeneration of process heat. In order to estimate the baseline parameters that result project participants should:

- Define $HG_{balance,BR,PO,y} = HG_{BL,BR,y} - \sum_i HG_{BL,BR,CG,y,i}$,
  $EL_{balance,PO,y} = EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$, and,

- Proceed to Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode.

Case 3.2.4: If $\mathrm{HG}_{\mathrm{BL,BR,y}} > \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}}$ and $HC_{BL,y} > HC_{BL,BR,CG,y}$, then there would be biomass-based heat in the baseline that could still be used and process heat demand to be met. It is assumed then that this balance of biomass-based heat would be extracted from the heat header and used to meet the process heat demand without cogeneration of power. Three cases should thus be considered (refer to the monitoring tables for a definitions of $h_{LOW,y}$ and $h_{HIGH,y}$ used in the equations below):

Case 3.2.4.1: If $\mathrm{HC}_{\mathrm{BL,y}} - \mathrm{HC}_{\mathrm{BL,BR,CG,y}} = \frac{\mathrm{h}_{\mathrm{LOW,y}}}{\mathrm{h}_{\mathrm{HIGH,y}}} \cdot \left(\mathrm{HG}_{\mathrm{BL,BR,y}} - \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \right)$, i.e. the balance of biomass-based heat (right-hand side of the equation) equals the remaining demand for process heat (left-hand side of the equation). Then there is no more biomass-based heat available and the demand for process heat has been met. It is assumed then that the use of fossil fuels on-site would be uncertain in the baseline scenario (except for the amount required due to technical constraints) because it would depend on a number of factors that are not taken into account in this methodology, particularly on the relative prices of on-site electricity generation using fossil fuels and the electricity price in the grid. In order to estimate the baseline parameters that result project participants should:

- Define $\mathrm{EL}_{\mathrm{BL,FF/GR,y}} = \mathrm{EL}_{\mathrm{BL,y}} - \mathrm{EL}_{\mathrm{BL,GR,y}} - \mathrm{EL}_{\mathrm{BL,BR,CG,y}}$, $\mathrm{EL}_{\mathrm{PJ,offset,y}} = 0$, $\mathrm{FF}_{\mathrm{BL,HG,y,f}} = 0$, and,
- Proceed to Step 5 Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Case 3.2.4.2: If $HC_{BL,y} - HC_{BL,BR,CG,y} > \frac{h_{LOW,y}}{h_{HIGH,y}} \cdot \left(HG_{BL,BR,y} - \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \right)$, i.e. the balance of biomass-based heat (right-hand side of the equation) is less than the remaining demand for process heat (left-hand side of the equation). Then all biomass-based heat was used and there still remains process heat demand to be met. It is assumed then that this process heat demand would be met by using fossil fuels in the baseline. In order to estimate the baseline parameters that result project participants should:

- Define $HC_{balance,FF,y} = \left(HC_{BL,y} - HC_{BL,BR,CG,y} \right) - \frac{h_{LOW}}{h_{HIGH}} \cdot \left(HG_{BL,BR,y} - \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \right)$,
  $\mathrm{EL}_{\mathrm{balance,FF,y}} = \mathrm{EL}_{\mathrm{BL,y}} - \mathrm{EL}_{\mathrm{BL,GR,y}} - \mathrm{EL}_{\mathrm{BL,BR,CG,y}}$, and,
- Proceed to Step 3: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation.

Case 3.2.4.3: If $HC_{BL,y} - HC_{BL,BR,CG,y} < \frac{h_{LOW}}{h_{HIGH}} \cdot \left(HG_{BL,BR,y} - \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \right)$, i.e. the balance of biomass-based heat (right-hand side of the equation) is greater than the remaining demand for process heat (left-hand side of the equation). Then the balance of heat produced with biomass residues is greater than the balance of process heat demand, meaning that there remains some biomass-based heat to be used after the demand for process heat was met. It is assumed then that this heat would be used to generate electricity in power-only mode, i.e. without cogeneration of process heat. In order to estimate the baseline parameters that result project participants should:

- Define $HG_{balance,BR,PO,y} = \left(HG_{BL,BR,y} - \sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \right) - \frac{h_{HIGH}}{h_{LOW}} \cdot \left(HC_{BL,y} - HC_{BL,BR,CG,y} \right)$,

  $\mathrm{EL}_{\mathrm{balance,PO,y}} = \mathrm{EL}_{\mathrm{BL,y}} - \mathrm{EL}_{\mathrm{BL,GR,y}} - \mathrm{EL}_{\mathrm{BL,BR,CG,y}}$, and,
- Proceed to Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode.

Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode

If power-only-type heat engines, i.e. heat engines that produce only electricity without cogeneration of process heat, have been identified in the baseline scenario, it is assumed that the balance of heat produced using biomass residues, if any, would be used in power-only mode.

$$\mathrm{EL}_{\mathrm{BL,BR,PO,y}} = \sum_{\mathrm{i}} \left(\mathrm{HG}_{\mathrm{BL,BR,PO,y,j}} \cdot \eta_{\mathrm{BL,EG,PO,j}} \right) \qquad \textbf{(21)}$$

Subject to,

$\sum_{\mathrm{i}} \mathrm{HG}_{\mathrm{BL,BR,PO,y,j}} \leq \mathrm{HG}_{\mathrm{balance,BR,PO,y}}$, i.e. the biomass-based heat used in the heat engines should not exceed the biomass-based heat balance; **(22)**

$\left(\mathrm{HG}_{\mathrm{BL,BR,PO,y,j}} \cdot \eta_{\mathrm{BL,EG,PO,j}} \right) \leq \mathrm{LOC}_{\mathrm{y}} \cdot \mathrm{CAP}_{\mathrm{EG,PO,j}} \cdot \mathrm{LFC}_{\mathrm{EG,PO,j}}$, i.e. the electricity generation in each heat engine should not exceed the total capacity of the heat engine. **(23)**

Where:

$\mathrm{EL}_{\mathrm{BL,BR,PO,y}}$	=	Baseline biomass-based electricity (power-only) in year *y* (MWh)
$\mathrm{HG}_{\mathrm{BL,BR,PO,y,j}}$	=	Baseline biomass-based heat used in heat engine *j* in year *y* (GJ)
$\eta_{\mathrm{BL,EG,PO,j}}$	=	Average electric power generation efficiency of heat engine *j* (MWh/GJ)
$\mathrm{HG}_{\mathrm{balance,BR,PO,y}}$	=	Baseline biomass-based heat balance after cogeneration in year *y* (GJ)
$\mathrm{LOC}_{\mathrm{y}}$	=	Length of the operational campaign in year *y* (hour)
$\mathrm{CAP}_{\mathrm{EG,PO,j}}$	=	Baseline electricity generation capacity of heat engine *j* (MW)
$\mathrm{LFC}_{\mathrm{EG,PO,j}}$	=	Baseline load factor of heat engine *j* (ratio)

The following cases are possible depending on the results of the calculations above:

Case 3.3.1: If $\mathrm{EL}_{\mathrm{balance,PO,y}} \geq \mathrm{EL}_{\mathrm{BL,BR,PO,y}}$, the amount of electricity generated on-site in the baseline is either equal to or less than the amount of electricity generated in the project scenario. In that case:

- Define $\mathrm{EL}_{\mathrm{BL,FF/GR,y}} = \mathrm{EL}_{\mathrm{balance,PO,y}} - \mathrm{EL}_{\mathrm{BL,BR,PO,y}}$, $\mathrm{EL}_{\mathrm{PJ,offset,y}} = 0$, $\mathrm{FF}_{\mathrm{BL,HG,y,f}} = 0$, and,
- Proceed to Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Case 3.3.2: If $\mathrm{EL}_{\mathrm{balance,PO,y}} < \mathrm{EL}_{\mathrm{BL,BR,PO,y}}$, the amount of electricity generated on-site in the baseline exceeds the amount of electricity generated in the project scenario. If grid-export was available in the baseline, this result indicates that the project activity results in a decrease of power output which is likely to be supplied by the grid. As a consequence, project emissions in the form of generation of electricity in the grid should be accounted for via the parameter $\mathrm{EL}_{\mathrm{PJ,offset,y}}$. In order to continue project participants should:

- Define $\mathrm{EL}_{\mathrm{BL,FF/GR,y}} = 0$, $\mathrm{EL}_{\mathrm{PJ,offset,y}} = EL_{BL,BR,PO,y} - EL_{balance,PO,y}$, $\mathrm{FF}_{\mathrm{BL,HG,y,f}} = 0$, and,
- Proceed to Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Step 3: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation

Step 4.1: Determine the baseline fossil fuel based cogeneration of process heat and electricity and the remaining process heat demand

In many cases the amount of biomass residues available is not enough to generate the heat required to meet the process heat demand. In such cases, and if fossil-fuel-based heat generators have been identified in the baseline scenario, it is assumed that the balance of process heat is met using fossil fuels, resulting in related fossil fuel baseline emissions. Where cogeneration capacity is still available it is assumed that the remaining process heat demand will first be supplied by cogeneration and then by direct use of heat supplied by heat generators.

$$HG_{BL,FF,CG,y,i} = \frac{(HPR_{BL,i} + 1 + GGL_{default})}{HPR_{BL,i}} \cdot HC_{BL,FF,CG,y,i}$$, i.e the amount of fossil fuel based heat required to supply the cogeneration heat engine *i* **(24)**

$$EL_{BL,FF,y} = \sum_{i} \frac{HC_{BL,FF,CG,y,i}}{HPR_{BL,i}}$$, i.e the amount of fossil fuel based electricity cogenerated by cogeneration heat engine i **(25)**

$$HG_{BL,FF,CG,y} = \sum_{i} HG_{BL,FF,CG,y,i} \quad \textbf{(26)}$$

Subject to,

$$\sum_{i} HC_{BL,FF,CG,y,i} \leq HC_{balance,FF,y}$$, i.e. the fossil fuel based cogenerated process heat should not exceed the balance of process heat demand, **(27)**

$$\frac{1}{3.6} \cdot \left((HG_{BL,FF,CG,y,i} + HG_{BL,BR,CG,y,i}) \cdot \frac{1}{(HPR_{BL,i} + 1 + GGL_{default})} \right) \leq LOC_{y} \cdot CAP_{EG,CG,i} \cdot LFC_{EG,CG,i}$$

(28)

Where:

$HG_{BL,FF,y,i}$	=	Baseline fossil-based heat used in heat engine *i* in year *y* (GJ)
$HC_{BL,BR,CG,y}$	=	Baseline biomass-based process heat cogenerated in year *y* (GJ)
$GGL_{default}$	=	The default value for the losses linked to the electricity generator group (turbine, couplings and electricity generator. Set at 0.05) (ratio)
$HPR_{BL,i}$	=	Baseline Heat Power Ratio of heat engine *i* (ratio)
$EL_{BL,FF,y}$	=	Baseline fossil-based electricity generation in year *y* (MWh)
$HG_{BL,FF,y,h}$	=	Baseline fossil-based heat generation in heat generator h in year *y* (GJ)
$HC_{balance,FF,y}$	=	Balance of process heat demand after cogeneration in year *y* (GJ)
$HG_{BL,FF,CG,y,i}$	=	Baseline fossil-fuel-based heat used in heat engine *i* in year *y* (GJ)
$HG_{BL,BR,CG,y,i}$	=	Baseline biomass-based heat used in heat engine *i* in year *y* (GJ)
LOC_{y}	=	Length of the operational campaign in year *y* (hour)
$CAP_{EG,CG,i}$	=	Baseline electricity generation capacity of heat engine *i* (MW)
$LFC_{EG,CG,i}$	=	Baseline load factor of heat engine *i* (ratio)
f	=	Fossil fuel type

y	=	Year of the crediting period
i	=	Cogeneration-type heat engine in the baseline scenario

In case after step 4.1 $HC_{balance,FF,y} > HC_{BL,FF,CG,y}$, then there would still be process heat demand to be met. It is assumed then that this balance of process heat would be generated with fossil fuels and extracted from the heat header and used to meet the process heat demand without cogeneration of power until all baseline process heat is met.

$$HG_{BL,FF,DHE,y} = (HC_{balance,FF,y} - HC_{BL,FF,CG,y}) \cdot \frac{h_{HIGH,y}}{h_{LOW,y}} \quad \textbf{(29)}$$

$$HG_{BL,FF,y} = HG_{BL,FF,CG,y} + HG_{BL,FF,DHE,y} \quad \textbf{(30)}$$

Where:

$HC_{balance,FF,y}$	=	Balance of process heat demand after cogeneration in year *y* (GJ)
$HC_{BL,FF,CG,y}$	=	Baseline fossil-fuel-based process heat cogenerated in year *y* (GJ)
$h_{LOW,y}$	=	Specific enthalpy of the heat carrier at the process heat demand side (GJ/tonnes)
$h_{HIGH,y}$	=	Specific enthalpy of the heat carrier at the heat generator side (GJ/tonnes)
$HG_{BL,FF,y}$	=	Baseline fossil-based heat generation in year *y* (GJ)
$HG_{BL,FF,DHE,y}$	=	Baseline fossil-based heat used to meet baseline process heat demand via direct heat extraction in year y (GJ)
$HG_{BL,FF,CG,y}$	=	Baseline fossil-based heat cogeneration in year y (GJ)

The following cases are possible depending on the results of the calculations above:

Case 4.1.1: If $EL_{balance,FF,y} \geq EL_{BL,FF,y}$, the amount of electricity generated on-site in the baseline is either equal to or less than the amount of electricity generated in the project scenario. In order to determine the resulting baseline emissions project participants should:

- Define $EL_{BL,FF/GR,y} = EL_{balance,FF,y} - EL_{BL,FF,y}$, $EL_{PJ,offset,y} = 0$, and,
- Proceed to Step 4.2 .

Case 4.1.2: If $EL_{balance,FF,y} < EL_{BL,FF,y}$, the amount of electricity generated on-site in the baseline exceeds the amount of electricity generated in the project scenario. If grid-export was available in the baseline, this result indicates that the project activity results in a decrease of power output which is likely to be supplied by the grid. As a consequence, project emissions in the form of generation of electricity in the grid should be accounted for via the parameter $EL_{PJ,offset,y}$. In order to determine the resulting baseline emissions project participants should:

- Define $EL_{BL,FF/GR,y} = 0$, $EL_{PJ,offset,y} = EL_{BL,FF,y} - EL_{balance,FF,y}$; and,
- Proceed to Step 4.2.

Step 4.2: Determine the baseline heat generation to meet the fossil-based cogeneration of heat and power and the heat to meet the balance of process heat

$$\sum_h HG_{BL,FF,y,h} = HG_{BL,FF,DHE,y} + HG_{BL,FF,CG,y} \quad \textbf{(31)}$$

$$FF_{BL,HG,y,f} = \sum_h \left(\frac{HG_{BL,FF,y,h}}{\eta_{BL,HG,FF,h}} \right) \quad \textbf{(32)}$$

Subject to:

$HG_{BL,FF,y,h} \leq LOC_y \cdot CAP_{HG,h} \cdot LFC_{HG,h}$, i.e. the heat generation in each heat generator should not exceed the total capacity of the heat generator; **(33)**

Where:

$FF_{BL,HG,y,f}$	=	Baseline fossil fuel demand for process heat in year *y* (GJ)
$HG_{BL,FF,y,h}$	=	Baseline fossil-based heat generation in heat generator *h* in year *y* (GJ)
$\eta_{BL,HG,FF,h}$	=	Baseline fossil-based heat generation efficiency of heat generator *h* (ratio)
LOC_y	=	Length of the operational campaign in year *y* (hour)
$CAP_{HG,h}$	=	Baseline capacity of heat generator *h* (GJ/h)
$LFC_{HG,h}$	=	Baseline load factor of heat generator *h* (ratio)
$HG_{BL,FF,DHE,y}$	=	Baseline fossil-based heat used to meet baseline process heat demand via direct heat extraction in year y (GJ)
$HG_{BL,FF,CG,y}$	=	Baseline fossil-based heat cogeneration in year y (GJ)

Proceed to Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

Step 4: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

The calculation of baseline emissions due to uncontrolled burning or decay of biomass residues is optional and project participants can decide whether to include these emission sources or not. If project participants wish to include these emission sources, the procedure below should be followed, and emissions from combustion of biomass residues under the project activity should be also be determined. Otherwise, this section does not need to be applied and project emissions do not need to include emissions from the combustion of biomass residues under the project activity.

$$BE_{BR,y} = BE_{BR,B1/B3,y} + BE_{BR,B2,y} \quad \textbf{(34)}$$

Where:

$BE_{BR,y}$	=	Baseline emissions due to disposal of biomass residues in year *y* (tCO_2e)
$BE_{BR,B1/B3,y}$	=	Baseline emissions due to aerobic decay or uncontrolled burning of biomass residues in year *y* (tCO_2)
$BE_{BR,B2,y}$	=	Baseline emissions due to anearobic decay of biomass residues in year *y* (tCO_2)

Step 5.1: Determine $BE_{BR,B1/B3,y}$

Baseline emissions are calculated by multiplying the quantity of biomass residues with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_n BR_{B1/B3,n,y} \cdot NCV_{BR,n,y} \cdot EF_{BR,n,y} \quad \textbf{(35)}$$

Where:

$BE_{BR,B1/B3,y}$	=	Baseline emissions due to aerobic decay or uncontrolled burning of biomass residues in year *y* (tCO2)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2/tCH4)
$BR_{B1/B3,n,y}$	=	Quantity of biomass residues of category *n* used in the project activity in year *y* for which the baseline scenario is B1: or B3: (tonnes on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category *n* in year *y* (GJ/tonne on dry-basis)
$EF_{BR,n,y}$	=	CH_4 emission factor for uncontrolled burning of the biomass residues category *n* during the year *y* (tCH_4/GJ)
n	=	Biomass residue category

To determine the CH_4 emission factor ($EF_{BR,n,y}$), project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of biomass as default value for the product of $NCV_{BR,n,y}$ and $EF_{BR,n,y}$.[10]

Step 5.2: Determine $BE_{BR,B2,y}$

For the biomass residues categories, as described in the biomass residues categories table, for which the most likely baseline scenario is that the biomass residues would decay under clearly anaerobic conditions (case B2), project participants shall calculate baseline emissions using the latest approved version of the tool "Emissions from solid waste disposal sites". The variable $BE_{CH4,SWDS,y}$ calculated by the tool corresponds to $BE_{BR,B2,y}$ in this methodology. The project participants shall use as waste quantities prevented from disposal ($W_{j,x}$) in the tool, those quantities of biomass residues ($BR_{n,B2,y}$) for which B2 has been identified as the most plausible baseline scenario, as summarized in the example in **Error! Reference source not found.**.

Step 5: Calculate baseline emissions

Calculate baseline emissions using equation 2 above.

Project emissions

For the purpose of determining GHG emissions of the project activity, project participants shall include the following emissions sources:

- Emissions from fossil fuel consumption at the project site for the generation of electric power and heat and for auxiliary loads related to the generation of electric power and heat;
- CO_2 emissions from grid-connected fossil fuel power plants in the electricity system for any electricity that is imported from the grid to the project site;
- If either $EL_{balance,PO,y} < EL_{BL,BR,PO,y}$ (Case 3.3.2) or $EL_{balance,FF,y} < EL_{BL,FF,y}$ (Case 4.2.2), CO_2 emissions from grid-connected fossil fuel power plants in the electricity system due to reduction in electricity generation at the project site as compared to the baseline scenario;
- CO_2 emissions from off-site transportation of biomass residues that are combusted in the project plant;
- If applicable, CH_4 emissions from combustion of biomass residues for electric power and heat generation at the project site;

[10] 2006 IPCC Guidelines, Volume 4, Table 2.5, default value for agricultural residues.

- If applicable, emissions from anaerobic treatment of wastewater originating from the treatment of the biomass residues prior to their combustion.

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y} \quad \textbf{(36)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
$PE_{FF,y}$	=	Emissions during the year y due to fossil fuel consumption at the project site (tCO_2)
$PE_{GR1,y}$	=	Emissions during the year y due to grid electricity imports to the project site (tCO_2)
$PE_{GR2,y}$	=	Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year *y* (tCO_2)
$PE_{TR,y}$	=	Emissions during the year y due to transport of the biomass residues to the project plant (tCO_2)
$PE_{BR,y}$	=	Emissions from the combustion of biomass residues during the year *y* (tCO_2e)
$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass residues in year *y* (tCO_2e)
$PE_{BG2,y}$	=	Emissions from the production of biogas in year *y* (tCO_2e)

Determination of PE_{FFy}

The following emission sources should be included in determining $PE_{FF,y}$:

- Emissions from on-site fossil fuel consumption for the generation of electric power and heat. This includes all fossil fuels used at the project site in heat generators (e.g. boilers) for the generation of electric power and heat; and
- Emissions from on-site fossil fuel consumption of auxiliary equipment and systems related to the generation of electric power and heat. This includes fossil fuels required for the operation of auxiliary equipment related to the power and heat plants (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.) which are not accounted in the first bullet, and fossil fuels required for the operation of equipment related to the preparation, storage and transportation of fuels (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.).

The latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" should be used to calculate $PE_{FF,y}$. All combustion processes *j* as described in the two bullets above should be included.

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad \textbf{(37)}$$

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 CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process j during the year y

The CO_2 emission coefficient $COEF_{i,y}$ are calculated using Option B, since the necessary data for Option A is not available in South Africa.

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad \textbf{(38)}$$

Where:

$COEF_{i,y}$	=	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

Option A should be the preferred approach, if the necessary data is available.

Determination of $PE_{GR1,y}$

If electricity is imported from the grid to the project site during year *y*, corresponding emissions should be accounted for as project emissions, as follows:

$$PE_{GR1,y} = EF_{EG,GR,y} \cdot EL_{PJ,imp,y} \quad \textbf{(39)}$$

Where:

$PE_{GR1,y}$	=	Emissions during the year *y* due to grid electricity imports to the project site (tCO_2)
$EL_{PJ,imp,y}$	=	Project electricity imports from the grid in year *y* (MWh)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)

Determination of $PE_{GR2,y}$

If $EL_{balance,PO,y} < EL_{BL,BR,PO,y}$ (Case 3.3.2) or $EL_{balance,FF,y} < EL_{BL,FF,y}$ (Case 4.2.2), the amount of electricity generated on-site in the baseline exceeds the amount of electricity generated in the project scenario. In such cases it is assumed that an equivalent amount of electricity is generated during year *y* in order to offset this reduction in electricity generation at the project site. Corresponding emissions should be accounted as project emissions as follows:

$$PE_{GR2,y} = EF_{EG,GR,y} \cdot EL_{PJ,offset,y} \quad \textbf{(40)}$$

Where:

$PE_{GR2,y}$	=	Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year *y* (tCO_2)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
$EL_{PJ,offset,y}$	=	Electricity that would be generated in the baseline that exceeds the generation of electricity during year *y* (MWh)

Determination of $PE_{TR,y}$

In cases where the biomass residues are not generated directly at the project site, project participants shall determine CO_2 emissions resulting from transportation of the biomass residues to the project plant using the latest version of the tool "Project and leakage emissions from road transportation of freight". $PE_{TR,m}$ in the tool corresponds to the parameter $\boldsymbol{PE_{TR,y}}$ in this methodology and the monitoring period m is one year.

Option B: Using conservative default values

This option relies on conservative default emission factors to estimate project or leakage emissions from road transportation of freight. These default values are established for two vehicle classes: light vehicles and heavy vehicles. Project emissions are determined as follows:

$$\left.\begin{matrix} PE_{TR,y} \\ LE_{TR,y} \end{matrix}\right\} = \sum_f D_{f,y} \cdot FR_{f,y} \cdot EF_{CO2,f} \cdot 10^{-6} \quad \textbf{(41)}$$

Where:

$PE_{TR,y}$	=	Project emissions from road transportation of freight in year *y* (tCO_2)
$D_{f,y}$	=	Return trip road distance between the origin and destination of freight transportation activity f in year *y* (km)
$EF_{CO2,f}$	=	Default CO_2 emission factor for freight transportation activity f (g CO_2 / t km)
$FR_{f,y}$	=	Total mass of freight transported in freight transportation activity f in year *y* (t)
f	=	Freight transportation activities conducted in the project activity in year *y*

Determination of $PE_{BR,y}$

If project proponents chose to include emissions due to uncontrolled burning or decay of biomass residues ($BE_{BR,y}$) in the calculation of baseline emissions, then emissions from the combustion of biomass residues have also to be included in the project scenario. Otherwise, this emission source need not be included. Corresponding emissions are calculated as follows:

$$PE_{BR,y} = GWP_{CH4} \cdot EF_{CH4,BR} \cdot \sum_n BR_{PJ,n,y} \cdot NCV_{BR,n,y} \quad \textbf{(42)}$$

Where:

$PE_{BR,y}$	=	Emissions from the combustion of biomass residues during the year *y* (tCO_2e)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2/tCH4)
$EF_{CH4,BR}$	=	CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ)
$BR_{PJ,n,y}$	=	Quantity of biomass residues of category n used in the project activity in year *y* (tonnes on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category n in year *y* (GJ/tonne on dry-basis)

Determination of $PE_{WW,y}$

This emission source should be estimated in cases where wastewater originating from the treatment of the biomass is (partly) treated under anaerobic conditions and where methane from the waste water is not captured and flared or combusted. Project emissions from waste water are estimated as follows:

$$PE_{WW,y} = GWP_{CH4} \cdot V_{WW,y} \cdot COD_{WW,y} \cdot B_{o,WW} \cdot MCF_{WW} \quad \textbf{(43)}$$

Where:

$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass residues in year *y* (tCO_2e)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4)
$V_{WW,y}$	=	Quantity of waste water generated in year *y* (m^3)
$COD_{WW,y}$	=	Average chemical oxygen demand of the waste water in year *y* ($tCOD/m^3$)
$B_{o,WW}$	=	Methane generation potential of the waste water ($tCH_4/tCOD$)
MCF_{WW}	=	Methane correction factor for the waste water (ratio)

Determination of $PE_{BG2,y}$

No biogas recovery is covered under the PoA thus no project emissions associated with the production of biogas are applicable.

Leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity. Changes in carbon stocks in the LULUCF sector are expected to be insignificant since this methodology is limited to biomass residues, as defined in the applicability conditions above.

The baseline scenarios for biomass residues for which this potential leakage is relevant are B5:, B6:, B7: and B8:.

$$LE_y = EF_{CO2,LE} \cdot \sum_n BR_{B5/B8,n,y} \cdot NCV_{BR,n,y} \quad \textbf{(44)}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2)
$EF_{CO2,LE}$	=	CO_2 emission factor of the most carbon intensive fossil fuel used in the country (tCO_2/GJ)
$BR_{B5/B8,n,y}$	=	Quantity of biomass residues of category n used in the project activity in year *y*, for which the baseline scenario is B5:, B6:, B7: or B8: (tonnes on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category *n* in year *y* (GJ/tonne on dry-basis)
n	=	Biomass residue category
y	=	Year of the crediting period

Changes required for methodology implementation in 2nd and 3rd crediting periods

At the start of the second and third crediting period for a CPA (if applicable), the continued validity of the baseline scenario shall be assessed by applying the latest version of the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

B.7. Data and parameters that are to be reported ex-ante

Document and justify all selected values in the CPA-DD. The following are not monitored data and parameters:

- **Baseline emissions parameters not monitored**

<table>
<tr><td>Data / Parameter</td><td>Biomass residues categories and quantities used for the selection of the baseline scenario selection and assessment of additionality</td></tr>
<tr><td>Unit</td><td>- Type (i.e. bagasse, rice husks, empty fruit bunches, etc.);
- Source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.);
- Fate in the absence of the project activity (scenarios B);
- Use in the project scenario (scenarios P);
- Quantity (tonnes on dry-basis)</td></tr>
<tr><td>Description</td><td>Explain and document transparently in the CDM-PDD, using a table similar to Table 2, which quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their baseline scenario. The last column of Table 2 corresponds to the quantity of each category of biomass residues (tonnes). For the selection of the baseline scenario and demonstration of additionality, at the validation stage, an ex ante estimation of these quantities should be provided</td></tr>
<tr><td>Source of data</td><td>On-site assessment of biomass residues categories and quantities</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><th>Biomass residues category (k)</th><th>Biomass residues type</th><th>Biomass residues source</th><th>Biomass residues fate in the absence of the project activity</th><th>Biomass residues use in project scenario</th><th>Biomass residues quantity (dry basis)</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Selection of the baseline scenario and assessment of additionality</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

Data / Parameter	$BR_{HIST,n,x}$
Unit	tonnes on dry-basis
Description	Quantity of biomass residues of category n used for power or heat generation at the project site in year x prior the date of submission of the PDD for validation of the project activity prior the time of submission of the PDD for validation of the project activity
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available). In case of volume meters use the fuel density to convert the measurement to mass basis
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step 1.4 in the case a biomass residues type from one particular source has been used prior to the implementation of the project activity partly in heat generators operated at the project site (B4:) and partly has been dumped, left to decay or burnt (B1:, B2:, B3:) and if this situation would continue in the baseline scenario

Data / Parameter	$BR_{n,h,x}$
Unit	tonnes on dry-basis
Description	Quantity of biomass residues of category n used in heat generator h in year x
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available)
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 of Step 1.5

Data / Parameter	$FF_{f,h,x}$
Unit	mass or volume unit/yr
Description	Quantity of fossil fuel type f fired in heat generator h in year x
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available). In case of volume meters use the fuel density to convert the measurement to mass basis
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to heat generators that were operated using fossil fuels at the project site for at least three calendar years prior the implementation of the CPA

Data / Parameter	$HG_{h,x}$
Unit	GJ
Description	Net quantity of heat generated in heat generator h in year x
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should be determined as the difference of the enthalpy of the heat (steam or hot water) generated by the heat generators(s) [in the project activity, monitored during year *y*,] minus the enthalpy of the feed-water, the boiler blow-down and any condensate return. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 of Step 1.5 if fossil fuels and biomass residues were used for heat generation in the heat generator h prior to the implementation of the project activity. In absence of temperature and pressure records, use the default values from equipment as reference

Data / Parameter	$HG_{BR,CG/PO,x,i,j}$
Unit	GJ
Description	Quantity of heat used in heat engine i/j in year x
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should be determined as the difference of the enthalpy of the process heat (steam or hot water) generated by the heat generators(s) [in the project activity, monitored during year *y*,] minus the enthalpy of the feed-water, the boiler blow-down and any condensate return. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 of Step 1.5

Data / Parameter	$HC_{BR,CG/PO,x,i/j}$
Unit	GJ
Description	Quantity of process heat extracted from the heat engine i/j in year x
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should be determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Case 1of Step 1.5

Data / Parameter	$EL_{BR,CG/PO,x,i/j}$
Unit	MWh
Description	Quantity of electricity generated in heat engine *i/j* in year *x*
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	Electricity meters
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 and/or Case 1of Step 1.5

Data / Parameter	P_x
Unit	Use suitable units, as appropriate
Description	Quantity of the main product of the production process (e.g. sugar cane, rice) produced in year x from plants operated at the project site
Source of data	On-site measurements
Value(s) applied	
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step 1.4 in the case a biomass residues type from one particular source has been used prior to the implementation of the project activity partly in heat generators operated at the project site (B4:) and partly has been dumped, left to decay or burnt (B1:, B2:, B3:) and if this situation would continue in the baseline scenario

Data / Parameter	$CAP_{HG,h}$
Unit	GJ/h
Description	Baseline capacity of heat generator h
Source of data	On-site measurements or reference plant design parameters
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should reflect the design maximum heat generation capacity (in GJ/h) of the baseline heat generator *h*. It should be based on the installed capacity of the heat generator. Project participants should document transparently and justify in the CDM-PDD how this parameter was determined
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$CAP_{EG,CG,i}$ $CAP_{EG,PO,j}$
Unit	MW
Description	$CAP_{EG,CG,i}$ = Baseline electricity generation capacity of heat engine i $CAP_{EG,PO,j}$ = Baseline electricity generation capacity of heat engine j
Source of data	On-site measurements or reference plant design parameters
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should reflect the design maximum electricity generation capacity (in MW) of the baseline heat engines *i*. It should be based on the installed capacity of the heat engines. Project participants should document transparently and justify in the CDM-PDD how this parameter was determined
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$LFC_{HG,h}$
Unit	Ratio
Description	Baseline load factor of heat generator h
Source of data	On-site measurements or reference plant design parameters
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should reflect the maximum load factor (i.e. the ratio between the 'actual heat generation' of the heat generator and its 'design maximum heat generation' along one year of operation) of the baseline heat generator *h*, taking into account downtime due to maintenance, seasonal operational patterns, and any other technical constraints. Project participants should document transparently and justify in the CDM-PDD how this parameter was determined (e.g. using historical records)
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$HPR_{BL,i}$
Unit	Ratio
Description	Baseline heat-to-power ratio of the heat engine *i*
Source of data	On-site measurements or reference plant design parameters
Value(s) applied	
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$LFC_{EG,CG,i}$ $LFC_{EG,PO,j}$
Unit	Ratio
Description	$LFC_{EG,CG,i}$ = Baseline load factor of heat engine i $LFC_{EG,PO,j}$ = Baseline load factor of heat engine j
Source of data	On-site measurements or reference plant design parameters
Value(s) applied	
Choice of data or Measurement methods and procedures	This parameter should reflect the maximum load factor (i.e. the ratio between the ‘actual electricity generation’ of the heat engine and its ‘design maximum electricity generation’ along one year of operation) of the baseline heat engine *i*. The actual electricity generation of the heat engine should be determined taking into account downtime due to maintenance, seasonal operational patterns, and any other technical constraints. Project participants should document transparently and justify in the CDM-PDD how this parameter was determined
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{BL,CO2,FF}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline
Source of data	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default emission factors (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the value in a conservative manner and justify the choice
Value(s) applied	
Choice of data or Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step 1.6 Option B In case of plants existing before project implementation, the lowest CO_2 emission factor should be used in case of multi fuel plants

Data / Parameter	$\eta_{BL,FF}$
Unit	ratio
Description	Efficiency of the fossil fuel power plant(s) at the project site in the baseline
Source of data	Either use the higher value among (a) the measured efficiency and (b) manufacturer's information on the efficiency; OR use default values as provided in Annex 1 of the "Tool to calculate the emission factor for an electricity system"; OR assume an efficiency of 100%
Value(s) applied	
Choice of data or Measurement methods and procedures	If measurements are conducted, use recognized standards for the measurement of the heat generator efficiency, such as the "*British Standard Methods for Assessing the thermal performance of boilers for steam, hot water and high temperature heat transfer fluids*" (BS845). Where possible, use preferably the direct method (dividing the net heat generation by the energy content of the fuels fired during a representative time period), as it is better able to reflect average efficiencies during a representative time period compared to the indirect method (determination of fuel supply or heat generation and estimation of the losses). Document measurement procedures and results and manufacturer's information transparently in the CDM-PDD
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step 1.6 Option B

Data / Parameter	$NCV_{BR,n,x}$
Unit	GJ/tonnes on dry-basis
Description	Net calorific value of biomass residues of category n in year x
Source of data	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default net calorific values (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the values in a conservative manner and justify the choice
Value(s) applied	
Choice of data or Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 of Step 1.5 The NCV is to be calculated for wet biomass as used in the heat generator (i.e. deducting the energy used for the evaporation of the water contained in the biomass residues). Biogas should be included as appropriate if applicable (in which case convenient units such as GJ/m^3 should be used)

Data / Parameter	$NCV_{FF,f,x}$
Unit	GJ/mass or volume unit
Description	Net calorific value of fossil fuel type f in year x
Source of data	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default net calorific values (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the values in a conservative manner and justify the choice
Value(s) applied	
Choice of data or Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 3 of Step 1.5 if fossil fuels and biomass residues were used for heat generation in the heat generator h prior to the implementation of the project activity.

Data / Parameter	GWP_{CH4}
Unit	tCO_2e/tCH_4
Description	Global Warming Potential of methane valid for the commitment period
Source of data	IPCC
Value(s) applied	
Choice of data or Measurement methods and procedures	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Purpose of data	Calculation of baseline/project emissions
Additional comment	Applicable to Step 5.1 and/or determination of $PE_{BR,y}$ and/or $PE_{WW,y}$

Data / Parameter	$\eta_{BL,HG,BR,h}$
Unit	Ratio
Description	Baseline biomass-based heat generation efficiency of heat generator *h*
Source of data	Default value or manufacturer's data
Value(s) applied	
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 1 or 2 of Step 1.5

Data / Parameter	$\eta_{BL,EG,CG,i}$
Unit	(MWh/GJ)
Description	Baseline electricity generation efficiency of heat engine *i*
Source of data	Default value or manufacturer's data
Value(s) applied	
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Option 1 or 2 of Step 1.5

- **Project emissions parameters not monitored**

Data / Parameter	$EF_{CO2,f}$
Unit	g CO_2 / t km
Description	Default CO2 emission factor for freight transportation activity f
Source of data	Default value
Value(s) applied	**Vehicle class** / **Emission factor (g CO_2 / t km)**: Light vehicles: 245; Heavy vehicles: 129
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of project/leakage emissions
Additional comment	Applicable to Option B of the determination of $PE_{TR,y}$

- **Grid emission factor parameters**

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Grid utility records / official sources
Value(s) applied	See detailed tables in Appendix 4 of the PoA-DD
Choice of data or Measurement methods and procedures	• Simple OM: 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-PoA-DD to the DOE for validation (*ex ante* option); • BM: For the first crediting period, either once *ex ante* or annually *ex post*, 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	Data vintage available at PoA validation: 2009 - 2011

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	Grid utility records / official sources
Value(s) applied	See detailed tables in Appendix 4 of the PoA-DD
Choice of data or Measurement methods and procedures	• Simple OM: 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-PoA-DD to the DOE for validation (*ex ante* option); • BM: For the first crediting period, either once *ex ante* or annually *ex post*, 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	-

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*

Source of data	IPCC default values at the lower limit of the uncertainty at a 95%confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories, as neither local nor national values are available.
Value(s) applied	See detailed tables in Appendix 4 of the PoA-DD
Choice of data or Measurement methods and procedures	• Simple OM: 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-PoA-DD to the DOE for validation (*ex ante* option); • BM: For the first crediting period, either once *ex ante* or annually *ex post*, 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	-

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Grid utility records / official sources
Value(s) applied	See detailed tables in Appendix 4 of the PoA-DD
Choice of data or Measurement methods and procedures	• Simple OM: 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-PoA-DD to the DOE for validation (*ex ante* option); • BM: For the first crediting period, either once *ex ante* or annually *ex post*, 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	Data vintage available at validation: 2009 - 2011

B.7.1. Ex-ante calculations of emission reductions

- **Baseline Emissions**

Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors in the baseline

Step 1.1: Determine total baseline process heat generation

	$HC_{BL,y}$	Yearly flow	Enthalpy	*Temperature*		*Pressure*		*condition*
	GJ	**t/y**	**kJ/kg**	*°C*	*(°F)*	*bar*	*(PSIg)*	
Feed-water								
Process loads								
Blow down								
Condensate return(s)								
Total (2-1-3-4)								

Step 1.2: Determine total baseline electricity generation

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y}$$

	$EL_{BL,y}$	$EL_{PJ,gross,y}$	$EL_{PJ,imp,y}$	$EL_{PJ,aux,y}$
Units	**MWh**	**MWh**	**MWh**	**MWh**
Year 1				
Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
(Year 8)				
(Year 9)				
(Year 10)				
TOTAL				

Step 1.3: Determine baseline capacity of electricity generation

$$CAP_{EG,total,y} = LOC_y \cdot \left(\sum_i CAP_{EG,CG,i} \cdot LFC_{EG,CG,i} + \sum_j CAP_{EG,PO,j} \cdot LFC_{EG,PO,j} \right)$$

	$CAP_{EG,total}$	LOC_y	$CAP_{EG,CG,i}$	$LFC_{EG,CG,i}$	$CAP_{EG,PO,j}$	$LFC_{EG,PO,j}$
Units	**MWh**	**hours**	**MW**	**ratio**	**MW**	**ratio**
Year 1						
Year 2						
Year 3						
Year 4						
Year 5						
Year 6						
Year 7						
(Year 8)						
(Year 9)						
(Year 10)						
TOTAL						

Step 1.4: Determine the baseline availability of biomass residues (dry basis)

	$BR_{PJ,n,y}$	$BR_{B4,bagasse,y}$	$BR_{B1/B3,leaves,y}$	$BR_{B1/B3,woodchips,y}$	$BR_{B5/B8,n,y}$
Units	**tons/y**	**tons/y**	**tons/y**	**tons/y**	**tons/y**
Year 1					
Year 2					
Year 3					
Year 4					
Year 5					
Year 6					
Year 7					
(Year 8)					
(Year 9)					
(Year 10)					
TOTAL					

Step 1.5: Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines

a) Efficiencies of heat generators

$\eta_{BL,HG,BR,h}$	$\eta_{BL,HG,FF,h}$
ratio	ratio

b) Efficiency of heat engines

$\eta_{BL,EG,CG,i}$
MWh/GJ

c) and Heat-to-Power Ratio

$HPR_{BL,i}$
ratio

Step 1.6: Determination of the emission factor of on-site electricity generation with fossil fuels

➔ *Option selection at CPA level*

Step 1.7: Determination of the emission factor of grid electricity generation

$EF_{EG,GR,y}$
tCO_2/MWh
0.948

Step 2: Determine the minimum baseline electricity generation in the grid

	$EL_{BL,GR,y} = max(0, EL_{BL,y} - CAP_{EG,total,y})$		
	$EL_{BL,GR,y}$	$EL_{BL,y}$	$CAP_{EG,total,y}$
Units	MWh	MWh	MWh
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Year 6			
Year 7			
(Year 8)			
(Year 9)			
(Year 10)			
TOTAL			

Step 3: Determine the baseline biomass-based heat and power generation

Step 3.1: Determine the baseline biomass-based heat generation

	$HG_{BL,BR,y}=\sum_h\sum_n(BR_{B4,n,h,y}\cdot NCV_{BR,n,y}\cdot\eta_{BL,HG,BR,h})$			
	$HG_{BL,BR,y}$	$BR_{B4,n,h,y}$	$NCV_{BR,n,y}$	$\eta_{BL,HG,BR,h}$
Units	**GJ**	**tonnes (dry)**	**GJ/tonne**	**ratio**
Year 1				
Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
(Year 8)				
(Year 9)				
(Year 10)				
TOTAL				

Subject to,

$$\sum_h\sum_n BR_{B4,n,h,y}=\sum_n BR_{B4,n,y}$$

$$\sum_n\left(BR_{B4,n,h,y}\cdot NCV_{BR,n,y}\cdot\eta_{BL,HG,BR,h}\right)\leq LOC_y\cdot CAP_{HG,h}\cdot LFC_{HG,h}$$

Step 3.2: Determine the baseline biomass-based cogeneration of process heat and electricity and heat extraction

	$EL_{BL,BR,CG,y}=\frac{1}{3.6}\sum_i(\frac{1}{HPR_{BL,i}+1+GGL_{default}}\cdot HG_{BL,BR,CG,y,i})$			
	$EL_{BL,BR,CG,y}$	$HPR_{BL,i}$	$GGL_{default}$	$HG_{BL,BR,CG,y,i}$
Units	**MWh**	**(GJ/MWh)**	**ratio**	**GJ**
Year 1				
Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
(Year 8)				
(Year 9)				
(Year 10)				
TOTAL				

	$HC_{BL,BR,CG,y}=\sum_i(\frac{HPR_{BL,i}}{HPR_{BL,i}+1+GGL_{default}}\cdot HG_{BL,BR,CG,y,i})$			
	$HC_{BL,BR,CG,y}$	$HPR_{BL,i}$	$GGL_{default}$	$HG_{BL,BR,CG,y,i}$
Units	**GJ**	**(GJ/MWh)**		**GJ**
Year 1				

Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
(Year 8)				
(Year 9)				
(Year 10)				
TOTAL				

Subject to,

$$\sum_i \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}} \leq \mathrm{HG}_{\mathrm{BL,BR,y}},\ HC_{BL,BR,CG,y} \leq \mathrm{HC}_{\mathrm{BL,y}} \text{ and}$$

$$\left(\eta_{\mathrm{BL,EG,CG,i}} \cdot \mathrm{HG}_{\mathrm{BL,BR,CG,y,i}}\right) \leq \mathrm{LOC}_{\mathrm{y}} \cdot \mathrm{CAP}_{\mathrm{EG,CG,i}} \cdot \mathrm{LFC}_{\mathrm{EG,CG,i}}$$

➔ *Case selection at CPA level*

Step 3.4: Determine the baseline biomass-based electricity generated in power-only mode

➔ *Applicability depending on configuration at CPA level*

Step 6: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation

➔ *Applicability depending on configuration at CPA level*

Step 7: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

➔ *Applicability depending on configuration at CPA level*

Step 8: Calculate baseline emissions

	$BE_y = \left\{EL_{BL,GR,y} \cdot EF_{EG,GR,y} + \sum FF_{BL,HG,y,f} \cdot EF_{FF,y,f} + EL_{BL,FF/GR,y} \cdot \min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}\right\}$							
	$\mathbf{BE}_{y}$	$\mathbf{EL}_{BL,GR,y}$	$\mathbf{EF}_{EG,GR,y}$	$\mathbf{FF}_{BL,HG,y,f}$	$\mathbf{EF}_{FF,y,f}$	$\mathbf{EL}_{BL,FF/GR,y}$	$\mathbf{EF}_{EG,FF,y}$	$\mathbf{BE}_{BR,y}$
Units	t CO_2e	MWh	tCO_2e/MWh	GJ	t CO_2e/GJ	MWh	tCO_2e/MWh	t CO_2e
Year 1								
Year 2								
Year 3								
Year 4								
Year 5								
Year 6								
Year 7								
(Year 8)								
(Year 9)								
(Year 10)								
Total								

- **Project emissions**

$$PE_y = \{PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y}\}$$

	PE_y	$PE_{FF,y}$	$PE_{GR1,y}$	$PE_{GR2,y}$	$PE_{TR,y}$	$PE_{BR,y}$	$PE_{WW,y}$	$PE_{BG2,y}$
Units	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2016								
2017								
2018								
2019								
2020								
2021								
2022								
2023								
2024								
2025								
TOTAL								

- **Leakage Emissions**

➔ *Applicability depending on configuration at CPA level*

B.8. Application of the monitoring methodology and description of the monitoring plan

B.8.1. Data and parameters to be monitored by each generic CPA

- **Baseline emissions parameters monitored:**

<table>
<tr><td>Data / Parameter</td><td>Biomass residues categories and quantities used in the project activity</td></tr>
<tr><td>Unit</td><td>- Type (i.e. bagasse, rice husks, empty fruit bunches, etc.);
- Source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.);
- Fate in the absence of the project activity (scenarios B);
- Use in the project scenario (scenarios P and H);
- Quantity (tonnes on dry-basis)</td></tr>
<tr><td>Description</td><td>Explain and document transparently in the CDM-PDD, using a table similar to Table 2, which quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their baseline scenario.

The last column of Table 2 corresponds to the quantity of each category of biomass residues (tonnes on dry-basis). These quantities should be updated every year of the crediting period as part of the monitoring plan so as to reflect the actual use of biomass residues in the project scenario. These updated values should be used for emissions reductions calculations.

Along the crediting period, new categories of biomass residues (i.e. new types, new sources, with different fate) can be used in the project activity. In this case, a new line should be added to the table. If those new categories are of the type B1:, B2: or B3:, the baseline scenario for those types of biomass residues should be assessed using the procedures outlined in the guidance provided in the procedure for the selection of the baseline scenario and demonstration of additionality</td></tr>
<tr><td>Source of data</td><td>On-site measurements</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><th>Biomass residues category (k)</th><th>Biomass residues type</th><th>Biomass residues source</th><th>Biomass residues fate in the absence of the project activity</th><th>Biomass residues use in project scenario</th><th>Biomass residues quantity (tonnes)</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Measurement methods and procedures</td><td>Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass.</td></tr>
<tr><td>Monitoring frequency</td><td>Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.</td></tr>
<tr><td>QA/QC procedures</td><td>Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data / Parameter	For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario
Unit	tonnes
Description	- Quantity of available biomass residues of type n in the region - Quantity of biomass residues of type n that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region - Availability of a surplus of biomass residues type n (which cannot be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region
Source of data	Surveys or statistics
Value(s) applied	
Measurement methods and procedures	Project participants may choose one among of the following procedures to demonstrate this: o Demonstrate that there is an abundant surplus of the type of biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of that type of biomass residues available in the region is at least 25% larger than the quantity of biomass residues of that type which is utilized in the region (e.g. for energy generation or as feedstock), including the project plant demand; o Demonstrate for the sites from where biomass residues are sourced that the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled or burnt without energy generation (e.g. field burning) prior to their use under the project activity. This approach is only applicable to biomass residues categories for which project participants can clearly identify the site from where the biomass residues are sourced.
Monitoring frequency	At the validation stage for biomass residues categories identified *ex-ante*, and always that new biomass residues categories are included during the crediting period
QA/QC procedures	-
Purpose of data	Calculation of baseline/leakage emissions
Additional comments	-

Data / Parameter	$BR_{PJ,n,y}$
Unit	tonnes on dry-basis
Description	Quantity of biomass residues of category n used in the project activity in year *y* (tonnes on dry-basis)
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	Crosscheck the measurements with an annual energy balance that is based on harvested/purchased quantities and stock changes
Purpose of data	Calculation of baseline emissions
Additional comments	The biomass residue quantities used should be monitored separately for (a) each type of biomass residue (e.g.) and each source (e.g. produced on-site, obtained from biomass residues suppliers, obtained from a biomass residues market, obtained from an identified biomass residues producer, etc.).

Data / Parameter	$BR_{B4,n,y}$
Unit	tonnes on dry-basis
Description	Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B4: (tonne on dry-basis)
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	Crosscheck the measurements with an annual energy balance that is based on harvested/purchased quantities and stock changes
Purpose of data	Calculation of baseline emissions
Additional comments	The procedures in **Error! Reference source not found.** on page **Error! Bookmark not defined.** of methodology ACM0006 should also be followed

Data / Parameter	$BR_{B1/B3,n,y}$
Unit	tonnes on dry-basis
Description	Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B1: or B3: (tonnes on dry-basis)
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	Crosscheck the measurements with an annual energy balance that is based on harvested/purchased quantities and stock changes
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	$BR_{B5/B8,n,y}$
Unit	tonnes of dry matter
Description	Quantity of biomass residues of category n used in the project activity in year y , for which the baseline scenario is B5:, B6:, B7: or B8:
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
Purpose of data	Calculation of baseline/leakage emissions
Additional comments	-

Data / Parameter	$EF_{BR,n,y}$
Unit	tCH_4/GJ
Description	CH_4 emission factor for uncontrolled burning of the biomass residues category n during the year y
Source of data	Conduct measurements or use reference default values
Value(s) applied	
Measurement methods and procedures	To determine the CH_4 emission factor, project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement In case of other data sources: Review the appropriateness of the data annually
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	Applicable to Step 5.1

Data / Parameter	$EF_{FF,y,f}$
Unit	tCO_2/GJ
Description	CO_2 emission factor for fossil fuel type f in year y
Source of data	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default emission factors (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the value in a conservative manner and justify the choice
Value(s) applied	
Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement In case of other data sources: Review the appropriateness of the data annually
QA/QC procedures	Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Purpose of data	Calculation of baseline emissions
Additional comments	Applicable to Step 4.2

Data / Parameter	$HC_{BL,y}$
Unit	GJ
Description	Baseline process heat generation in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	This parameter should be determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return of the heat generators. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
Monitoring frequency	Calculated based on continuously monitored data and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	$EL_{PJ,gross,y}$
Unit	MWh
Description	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y*
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use calibrated electricity meters.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years)
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	$EL_{PJ,imp,y}$
Unit	MWh
Description	Project electricity imports from the grid in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use calibrated electricity meters.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	The consistency of metered electricity generation should be cross-checked with receipts from electricity purchases
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	$EL_{PJ,aux,y}$
Unit	MWh
Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Use calibrated electricity meters.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years).
Purpose of data	Calculation of baseline emissions
Additional comments	$EG_{PJ,aux,y}$ shall include all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power plants which are located at the project site and included in the project boundary (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.)

Data / Parameter	$NCV_{BR,n,y}$
Unit	GJ/tonnes of dry matter
Description	Net calorific value of biomass residue of category n in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Measurements shall be carried out at reputed laboratories and according to relevant international standards.
Monitoring frequency	Measure the NCV on dry-basis, at least every six months, taking at least three samples for each measurement.
QA/QC procedures	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Purpose of data	Calculation of baseline emissions
Additional comments	Ensure that the NCV is determined on the basis of dry biomass.

Data / Parameter	$h_{LOW,y}$ $h_{HIGH,y}$
Unit	GJ/tonnes
Description	$h_{LOW,y}$ = Specific enthalpy of the heat carrier at the process heat demand side $h_{HIGH,y}$ = Specific enthalpy of the heat carrier at the heat generator side
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	The specific enthalpies should be determined based on the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	Applicable to outcomes 3.2.4 of Step 3.2 The process heat demand side refers to where heat is finally used for heating purposes by end-users and the heat generator side refers to where heat is generated

Data / Parameter	Moisture content of the biomass residues
Unit	% Water content in mass basis in wet biomass residues
Description	Moisture content of each biomass residues type *k*
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	The moisture content should be monitored for each batch of biomass of homogeneous quality.
Monitoring frequency	The weighted average should be calculated for each monitoring period and used in the calculations.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	P_y
Unit	Use suitable units, as appropriate
Description	Quantity of the main product of the production process (e.g. sugar cane, rice) produced in year y from plants operated at the project site
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Data aggregated as appropriate
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

Data / Parameter	LOC_y
Unit	hour
Description	Length of the operational campaign in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	Record and sum the hours of operation of the project activity facilities during year *y*.
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

- **Project emissions parameters monitored:**

Parameters to determine project emissions from fossil fuel consumption (if applicable):

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 measurements
Value(s) applied	
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	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	-

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)</td></tr>
<tr><td>Description</td><td>Weighted average net calorific value of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>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)</td></tr>
<tr><td>d) IPCC default values at the upper 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</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
<tr><td>Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency</td><td>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</td></tr>
<tr><td>QA/QC procedures</td><td>Verify if the values under a), b) and c) 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.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of project emissions.</td></tr>
<tr><td>Additional comments</td><td>Applicable where Option B is used</td></tr>
</table>

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,j}$</td></tr>
<tr><td>Unit</td><td>tCO_2/GJ</td></tr>
<tr><td>Description</td><td>Weighted average CO_2 emission factor of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>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)</td></tr>
<tr><td>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</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
<tr><td>Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency</td><td>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</td></tr>
<tr><td>QA/QC procedures</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Calculation of project emissions</td></tr>
<tr><td>Additional comments</td><td>Applicable where Option B is used
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.</td></tr>
</table>

Parameters to determine project emissions from transport of the biomass residues (if applicable):

Data / Parameter	$D_{f,y}$
Unit	kilometre
Description	Return trip road distance between the origin and destination of freight transportation activity f in year *y*
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources)
Monitoring frequency	To be updated whenever the road distance changes.
QA/QC procedures	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
Purpose of data	Calculation of project/leakage emissions
Additional comments	Applicable to Option B

Data / Parameter	$FR_{f,y}$
Unit	tonnes
Description	Total mass of freight transported n freight transportation activity f in year y
Source of data	Records by project participants or records by truck operators
Value(s) applied	
Measurement methods and procedures	Using weight or volume meters. If volume meters are used convert to mass units using the density of each category of biomass residues.
Monitoring frequency	Data monitored continuously and aggregated as appropriate
QA/QC procedures	Check consistency of mass records with biomass residues categories and quantities used in the project activity
Purpose of data	Calculation of project/leakage emissions
Additional comments	Applicable to Option B

Parameters to determine project emissions from combustion of biomass residues (if applicable):

Data / Parameter	$EF_{CH4,BR}$
Unit	tCH_4/GJ
Description	CH_4 emission factor for the combustion of biomass residues in the project plant
Source of data	On-site measurements or default values, as provided in **Error! Reference source not found.**
Value(s) applied	
Measurement methods and procedures	The CH_4 emission factor may be determined based on a stack gas analysis using calibrated analyzers
Monitoring frequency	At least quarterly, taking at least three samples per measurement
QA/QC procedures	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
Purpose of data	Calculation of project emissions
Additional comments	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary ($PE_{BR,y}$). Note that a conservative factor shall be applied, as specified in the baseline methodology

Parameters to determine project emissions from wastewater (if applicable):

Data / Parameter	$V_{WW,y}$
Unit	m^3
Description	Quantity of waste water generated in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	-
Monitoring frequency	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to the determination of $PE_{WW,y}$

Data / Parameter	$COD_{WW,y}$
Unit	tCOD/m³
Description	Average chemical oxygen demand of the waste water in year y
Source of data	On-site measurements
Value(s) applied	
Measurement methods and procedures	-
Monitoring frequency	In case of measurements: At least every six months, taking at least three samples for each measurement
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to the determination of $PE_{WW,y}$

Data / Parameter	$B_{o,WW}$
Unit	$tCH_4/tCOD$
Description	Methane generation potential of the waste water
Source of data	Reference default values (IPCC)
Value(s) applied	
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to the determination of $PE_{WW,y}$

Data / Parameter	MCF_{WW}
Unit	ratio
Description	Methane correction factor for the waste water
Source of data	Reference default values (IPCC)
Value(s) applied	
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to the determination of $PE_{WW,y}$

- **Leakage parameters monitored**

Data / Parameter	$EF_{CO2,LE}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of the most carbon intensive fossil fuel used in the country
Source of data	Identify the most carbon intensive fuel type from the national communication, other literature sources (e.g. IEA). Possibly consult with the national agency responsible for the national communication / GHG inventory. If available, use national default values for the CO_2 emission factor. Otherwise, IPCC default values may be used
Value(s) applied	
Measurement methods and procedures	-
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	Calculation of leakage emissions
Additional comments	Applicable to leakage determination for the categories of biomass residues whose baseline scenario has been identified as B5:, B6:, B7: or B8:

B.8.2. Description of the monitoring plan for a generic CPA

Details of the monitoring plan will be described within each CPA due to the size, location and nature-specific characteristics of projects under this proposed PoA.

Each CPA monitoring plan will comply with the methodology ACM0006 and the CDM Project Standard.

Monitoring organization

The CME will establish and maintain a database for each CPA. The CME will record CPA information detail delivered by CPA implementer, as follows:

- Name of the CPA,
- Name of CPA implementer,
- Contact details of CPA implementer,
- Capacity of the power-and-heat plant and other relevant technical specifications of each CPA,
- GPS coordinates of each CPA,
- Verification status (number of verification and associated monitoring period),
- Emission reductions monitored and issued each monitoring period.

The CME will be responsible for the management of records and data associated with each CPA. Data monitored and required for verification and issuance will be kept and archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

The database will be updated using the data supplied by the CPA implementer. It will form the basis for the verification of CPA and be available for inspection by the DOE at any point in time.

For each CPA, all parameters included in section B.7.1. will be monitored by the CPA implementer, recorded electronically, and provided to the CME.

Data quality

CPA implementer will have to implement a QA/QC procedure to ensure that data provided meet the requirements of the monitoring plan.

The data and reports provided by each CPA implementer to the CME will be checked internally to ensure the accuracy and completeness of data. In case of mistakes, corrective action will be applied to avoid future similar mistakes. If applicable, the CPA implementer will have to deliver equipments calibration certificates to the CME.

The CME will crosscheck, reconcile or consolidate data with multiple sources whenever possible. At minimum, data obtained from the electricity meters is to be crosschecked with the electricity sales receipts. This kind of reconciliation activity will be recorded properly as DOE may request for such information during the verification.

Monitoring team and training

Data collection, consolidation and results analysis will be undertaken by a dedicated team adequately trained, well aware of CDM requirements and supervised by the CME. This team will not have any hierarchical relationships or dependence links with all entities involved to measure net electricity supplied to the grid and to assure the correct operation and maintenance of the measuring equipment either within the CME and/or CPA implementers. This independence shall guarantee the integrity of the work that will be done.

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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	-
Postcode	EC2V 7JE
Country	United Kingdom of Great Britain and Northern Ireland
Telephone	+44 20 3145 6890
Fax	+44 20 3189 6930
E-mail	co2@standardbank.com
Website	www.standardbank.com
Contact person	Geoff Sinclair
Title	Head of Carbon Sales & Trading
Salutation	Mr
Last name	Sinclair
Middle name	-
First name	Geoff
Department	Energy Trading and Marketing
Mobile	+44 7769 648 695
Direct fax	-
Direct tel.	+44 20 3145 6893
Personal e-mail	geoff.sinclair@standardbank.com

CDM consultant

ecosur afrique

Alexandre Dunod (CDM Project Manager)
a.dunod@ecosurafrique.com

Aurélie Lepage (COO)
a.lepage@ecosurafrique.com

ecosur afrique is not a project participant.

Appendix 2: Affirmation regarding public funding

The PoA does not expect to involve any public funding according to the OECD definitions for Official Development Assistance (ODA).

Appendix 3: Application of methodology(ies)

Not applicable.

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

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

The grid emission factor ($EF_{grid,CM,y}$) is calculated ex-ante as per the "Tool to calculate the emission factor for an electricity-system" (Version 02.2.1). The emission factor is not monitored during the crediting period of each CPA but shall be updated with the latest version of the PoA-DD at each CPA inclusion and at the renewal of the crediting period of the CPA.

This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the "operating margin" (OM) and the "build margin" (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the CPA. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the CPA.

This tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year *y*
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year *y*
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year *y*

The tool indicates six steps for the calculation of the combined margin (CM) emission factor:

STEP 1. Identify the relevant electricity systems.

The DNA of South Africa has not published any delineation on the project electricity system and connected electricity system. Thus the project participants define the project electricity system as the complete South African electricity grid (please refer to the following figure), as it is recommended in the tool to use the national grid as a default. No other electricity system is located within the country, thus no internal imports take place.

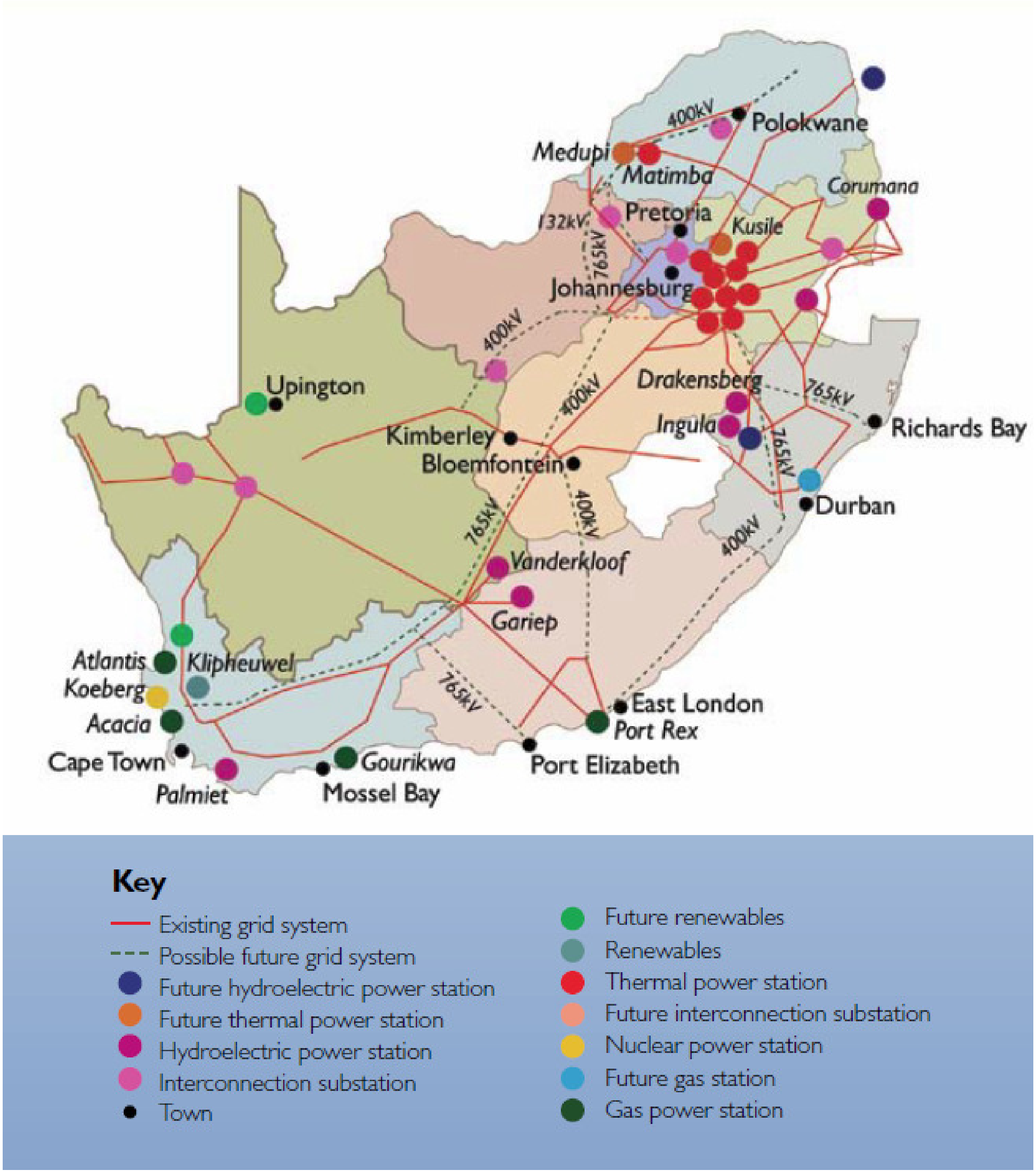

Figure 4: *South African grid map (source: Eskom Annual Report 2011, p.10)*

Eskom is operator of the grid operator. This public utility generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and to redistributors in South Africa. This company generated 93.89% of the electricity used in South Africa in 2010[11]. As shown in the table below, the remainder was imported from other neighbouring countries (5.38%) and bought from IPPs (0.72%).

For the purpose of determining the operating margin, the CO_2 emission factor for the net electricity imports is 0 tCO_2/MWh.

[11] Between 04-2010 and 03-2011.

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

The tool allows selecting one of the following two options to calculate the operating margin and build margin emission factor:

Option 1: Only grid power plants are included in the calculation.

Option 2: Both grid power plants and off-grid power plants are included in the calculation.

Because off-grid power plants are not considered, **Option 1** is selected for the calculation of both the operating and build margin emission factors.

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

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

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

As displayed in the table below, the low-cost/must run resources constitute less than 50% of the total grid generation over the past 5 years, with an average share of 5.55%. Therefore method (a), simple OM, is applied.

Table 6: S*hare of low cost/must run power plants*

Type of power plant	04-2006 / 03-2007	04-2007 / 03-2008	04-2008 / 03-2009	04-2009 / 03-2010	04-2010 / 03-2011
Coal-fired	88.23%	88.94%	87.89%	87.58%	87.09%
Pumped storage[12]	1.21%	1.19%	1.15%	1.11%	1.17%
Gas turbine	0.03%	0.46%	0.06%	0.02%	0.08%
Hydro-electric	1.00%	0.30%	0.45%	0.52%	0.78%
Wind energy	0.00%	0.00%	0.00%	0.00%	0.00%
Nuclear	4.83%	4.52%	5.39%	5.19%	4.78%
Low-cost/ust-run sources (Hydro + Wind + Nuclear)	5.83%	4.82%	5.84%	5.71%	5.56%
Total Eskom generation	95.29%	95.41%	94.95%	94.42%	93.89%
IPP	0.00%	0.00%	0.00%	0.00%	0.72%
Foreign purchase	4.71%	4.59%	5.05%	5.58%	5.38%

[12] Pumped storage facilities have storage dams, and use primarily coal fired electricity to pump water into the reservoir during off peak hours. This means that these facilities are not actually 'power plants' in the sense of converting a primary energy source into electricity. They will not be included in the emission factor calculations because they are net consumers of electricity, not generators. http://www.carbon.org.za/resources/docs/Spalding_FecherGEF_for_SA.pdf

For the simple OM, the option chosen for the emission factor is the *ex ante* data vintage: 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 i.e. 2008/2009, 2009/2010 and 2010/2011.

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

According to the tool, the simple OM emission factor ($EF_{OM,ave,y}$) is calculated as the generation-weighted average CO_2 emissions per unit (tCO_2/MWh) of all generating power plants serving the system, not including the low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:
Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

According to the tool, Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I - only grid power plants are included in the calculation- has been chosen in **STEP 2**).

Since the necessary data for option A is available, this option is used for the calculation.

Option A is applied:

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

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

Where:

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

When data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows (**option A1** of the tool):

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

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)

$\mathbf{EF_{CO2,i,y}}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$\mathbf{EG_{m,y}}$		Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units
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.

Otherwise, if for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows (**option A2** of the tool):

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

Where:

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

Where several fuel types are used in the power unit, use the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y}$.

The availability of the necessary consumption data for each fossil fuel used depends on the power plants therefore both options A1 and A2 are used depending on the different power plants in the calculation.

Determination of $EG_{m,y}$

$EG_{m,y}$ is determined once for each crediting period, using the most recent three historical years provided by ESKOM for which data is available at the time of submission of the CDM-PoA-DD to the DOE for validation (ex-ante) i.e. 2008/2009 to 2010/2011.

For this approach (simple OM) to calculate the operating margin, the subscript *m* refers to power plants/units delivering electricity to the grid, not including low-cost/must run power plants and including electricity imports to the grid. Electricity imports are treated as one power plant *m*.

Eskom's official reported average Net Calorific Value (NCV) of coal for all power plants was 19.0, 19.22 and 19.45 GJ/tonne in 2008/2009, 2009/2010 and 2010/2011.[13]

For carbon emission factor, Eskom does not report a value for this, so the IPCC 2006 Guidelines default value should be used (at the lower limit of 95% confidence), which is 0.0895 tCO2 /GJ (IPCC 2006).

While Gourikwa operates on gas and Acacia, Port Rex and Ankerlig operate on diesel/kerosene, Eskom does not report annual generation for each of these plants. To be conservative, all generation from 'gas turbine' plants use the natural gas IPCC emission factor i.e. 0.0543tCO_2/GJ). Because fuel consumption data for these plants is also not available from Eskom, the default efficiency of 39.5% from the Tool (value for natural gas open cycle) was used to calculate the emissions factor for these gas turbine stations.

[13] The default IPCC 2006 Guidelines value is 25.8 GJ/tonne (IPCC, 2006). The Tool specifies that the lower bound of the 95% confidence level should be used, which in the IPCC guideline is 19.9 GJ/tonne for 'other bituminous coal'. Therefore the use of Eskom values is conservative.

Fuel consumption data for "*Newcastle Cogeneration Plant*" operated by IPSA is also not available. The default efficiency of 37.5% from the Tool (value for natural gas steam turbine) was used to calculate the emissions factor for this cogeneration plant.

Based on 2008/2009, 2009/2010 and 2010/2011, the calculated Operating Margin is: **0.9254 tCO_2/MWh.**

STEP 5. Calculate the build margin (BM) emission factor.

Option 1: For the first crediting period, project participants calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PoA-DD submission to the DOE for validation (year 2009). This option does not require monitoring the emission factor during the crediting period.

Capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin are determined as per the following procedure, consistent with the data vintage selected above:

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

- The set of five power units that started to supply electricity to the grid most recently represents a net electricity production (in year 2010/2011) **$AEG_{SET\text{-}5\text{-units}}$ = 24,877,585 MWh.**

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

- AEG_{total} = 236,165,663 MWh and the set of power capacity additions in the electricity system that comprise 20% of the system generation (i.e. 47,2322,133 MWh in year 2010/2011) and that started to supply electricity to the grid most recently corresponds to a total set of **$AEG_{SET\text{-}\geq 20\%}$= 50,525,843 MWh.**

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

- The set of power units that comprises the larger annual generation is **SET_{sample} = $SET_{\geq 20\%}$**.

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

Otherwise:

d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20%

falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

- Kendal power station and Majuba power station started to supply electricity to the grid more than 10 years ago therefore they are excluded from SET_{sample}.
- There are 4 registered CDM projects that supply electricity to the grid: Alton Landfill Gas to Energy Project, Durban landfill Gas Bisasar Road, PetroSA biogas to energy and Bethlehem Hydroelectric project. Therefore these 4 power units are included in SET_{sample}.
- $SET_{\text{-}sample\text{-}CDM}$ = 389,940 MWh

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

- $AEG_{SET\text{-}sample\text{-}CDM} < 0.2 \times AEG_{total}$ therefore steps (e) and (f) are applied.

Otherwise,

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

- Kendal power station and Majuba power station started to supply electricity to the grid more than 10 years ago therefore they are included in $\mathbf{SET_{sample\text{-}CDM}}$.
- $\mathbf{AEG_{sample\text{-}CDM\text{-}>10yrs}}$ **= 50,670,783 MWh.**

Table 7: *Set of power units under consideration* ($AEG_{sample\text{-}CDM\text{-}>10yrs}$)

Name of power plants included in the build margin (interconnected grid)	CDM?	Date of operation	Fuel Type	Net power generation in 2010/2011 (GWh)	Cumulated share (%)
Kendal	No	01/10/1988	Coal	25,648,258	21.37%
Majuba	No	01/04/1996	Coal	24,632,585	10.51%
Klipheuwel Wind Energy Facility	No	01/08/2002	Wind	2,000	0.08%
Ankerlig[14]	No	29/03/2007	Gas	197,000	0.08%
Gourika	No	30/03/2007	Gas		
Newcastle Cogeneration Plant	No	2007	Gas	46,000	0.08%
PetroSA biogas to energy	Yes	01/10/2007	Biogas	37,214	0.06%
Durban Landfill-Gas Bisasar Road	Yes	01/03/2008	Biogas	67,800	0.05%
Alton Landfill Gas to Energy Project	Yes	01/08/2009	Biogas	2,926	0.02%
Bethlehem Hydroelectric project	Yes	01/11/2009	Hydro	37,000	0.02%

AEG total	236,165,663

[14] Note that Eskom does not report fuel use and production individually for Ankerlig and Gourika power plants, so data for this entire class has been used.

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

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

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 electricity generation data is available.

The Build Margin is calculated to be: **0.9710 tCO_2/MWh**.

STEP 6. Calculate the combined margin (CM) emission factor.

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on the following method:

(a) Weighted average CM;

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

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 *y* (tCO_2/MWh)
w_{OM}	= Weighting of operating margin emissions factor (%)
w_{BM}	= Weighting of build margin emissions factor (%)

According to the tool, default values for other projects than wind and solar power generation project activities are: w_{OM}= 0. 5 and w_{BM} = 0.5.

Based on 2008/2009, 2009/2010 and 2010/2011, the combined margin emission factor $CEF_{elec,GRID}$ is **0.9482 tCO_2/MWh**.

Further information on grid emission factor calculation

LIST OF POWER UNITS CONNECTED TO THE SOUTH AFRICAN POWER GRID

Plant names	Operator	Installed capacity (MW)	Commissioning date	Type of Power Plant	Fossil Fuel type	CDM
Pretoria West Coal PS	Pretoria Municipality	180.0	?	Thermal PP	Coal	No
Bloemfontein Coal PS	Bloemfontein Munici.	103.0	?	Thermal PP	Coal	No
Sasol Synthetic Fuels SA	Sasol	600.0	?	Thermal PP	Coal	No
Swartkops Coal PS	Swartkops Munici.	240.0	?	Thermal PP	Coal	No
Sasol Chemical Industry SA	Sasol	130.0	?	Thermal PP	Coal	No
Kelvin A and B Therm. PS	Kelvin Power	600.0	1957	Thermal PP	Coal	No
Komati	Eskom	1,000.0	06/11/1961	Thermal PP	Coal	No
Rooiwal Coal PS	Rooiwal City	300.0	1963	Thermal PP	Coal	No
Camden	Eskom	1,600.0	21/12/1966	Thermal PP	Coal	No
Grootvlei	Eskom	1,200.0	30/06/1969	Thermal PP	Coal	No
Hendrina	Eskom	1,895.0	12/05/1970	Thermal PP	Coal	No
Gariep	Eskom	360.0	08/09/1971	Hydro	N/A	No
Arnot	Eskom	1,980.0	21/09/1971	Thermal PP	Coal	No
Van Der Kloof	Eskom	240.0	01/01/1977	Hydro	N/A	No
Kriel	Eskom	2,850.0	06/05/1976	Thermal PP	Coal	No
Acacia	Eskom	171.0	13/05/1976	OCGT	Gas	No
Port Rex	Eskom	171.0	30/09/1976	OCGT	Gas	No
First Falls	Eskom	6.0	01/02/1979	Hydro	N/A	No
Second Falls	Eskom	11.0	01/04/1979	Hydro	N/A	No
Matla	Eskom	3,450.0	29/09/1979	Thermal PP	Coal	No
Duvha	Eskom	3,450.0	18/01/1980	Thermal PP	Coal	No
Ncora	Eskom	2.0	01/03/1983	Hydro	N/A	No
Koeberg	Eskom	1,800.0	21/07/1984	Nuclear	N/A	No
Colley Wobbles	Eskom	42.0	01/01/1985	Hydro	N/A	No
Tutuka	Eskom	3,510.0	01/06/1985	Thermal PP	Coal	No
Lethabo	Eskom	3,558.0	22/12/1985	Thermal PP	Coal	No
Matimba	Eskom	3,690.0	04/12/1987	Thermal PP	Coal	No
Kendal	Eskom	3,840.0	01/10/1988	Thermal PP	Coal	No
Majuba	Eskom	3,843.0	01/04/1996	Thermal PP	Coal	No
Klipheuwel	Eskom	3.0	01/08/2002	Wind Farm	N/A	No
Newcastle Cogen. Plant	IPSA	18.0	2007	CCGT	Gas	No
Ankerlig	Eskom	1,327.0	29/03/2007	OCGT	Gas	No
Gourika	Eskom	740.0	30/03/2007	OCGT	Gas	No
PetroSA biogas to energy	PetroSa	4.2	01/10/2007	Biogas	N/A	YES
Durban LFG Bisasar Road	eThekwini Munici.	6.9	01/03/2008	Biogas	N/A	YES
Alton LFGTE Project	ENER·G Systems	0.4	01/08/2009	Biogas	N/A	YES
Bethlehem Hydro project	Bethlehem Hydro	7.0	01/11/2009	Hydro	N/A	YES

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

Table 8: *Emissions of the set of power units included in the Build Margin*

Name of power plants included in the build margin (interconnected grid)	Fuel Type	Net power generation in 2010/2011	Emission factor of the power unit	CO_2 emission
		GWh	tCO_2/MWh	tCO_2
Kendal	Coal	25,648,258	1.030	26,415,392
Majuba	Coal	24,632,585	0.920	22,665,782
Klipheuwel Wind Energy Facility	Wind	2,000	0.000	0
Ankerlig	Gas	197,000	0.495	97,493
Gourika	Gas			
Newcastle Cogeneration Plant	Gas	46,000	0.521	23,979
PetroSA biogas to energy	Biogas	37,214	0.000	0
Durban Landfill-Gas Bisasar Road	Biogas	67,800	0.000	0
Alton Landfill Gas to Energy Project	Biogas	2,926	0.000	0
Bethlehem Hydroelectric project	Hydro	37,000	0.000	0

Net power generation of the SET in MWh	50,670,783
CO_2 emission of the SET in tCO_2	49,202,645
Build Margin Emission factor	0.9710

Appendix 5: Further background information on the monitoring plan

Not applicable

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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 CDM programmes of activities" (EB 66, Annex 12).
01	EB33, Annex41 27 July 2007	Initial adoption.
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