Monitoring report form for CDM project activity (Version 08.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT			
Title of the project activity	BK Energia Itacoatiara Project		
UNFCCC reference number of the project activity	0168		
Version number of the PDD applicable to this monitoring report	6.6		
Version number of this monitoring report	1.0		
Completion date of this monitoring report	22/06/2021		
Monitoring period number	15		
Duration of this monitoring period	01/01/2020 – 31/12/2020		
Monitoring report number for this monitoring period	Not applicable		
Project participants	BK Energia Itacoatiara Ltda. Precious Woods Holding Ltd. Foundation myclimate - The Climate Protection Partnership		
Host Party	Brazil		
Applied methodologies and standardized baselines	Sectoral Scope 1, Energy industries: AMS - I.D – Grid connected renewable electricity generation (version 18) Sectoral Scope 13, Waste handling and disposal: AMS-III.E. – Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment (version 17)		
Sectoral scopes	Sectoral Scope 1, Energy industries Sectoral Scope 13, Waste handling and disposal		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	-	40,776 t CO_2e	-
Amount of GHG emission reductions or net anthropogenic GHG removals	29,658 t CO_2e		

estimated ex ante for this monitoring period in the PDD	

SECTION A. Description of project activity

A.1. General description of project activity

>>

The project generates electricity with a thermoelectric power plant (see picture below) using wood waste from an FSC®[1] certified forest and a wood processing company in the city of Itacoatiara, in the State of Amazonas, Brazil or from other demonstrably renewable sources out of region. The power plant replaces several diesel generators and supplies the local grid of the town of Itacoatiara (approx. 80,000 inhabitants) in a region supplied by 100% diesel fuelled electrical electricity generators. Thus, it reduces greenhouse gas emission by substituting fossil with renewable energy.

Figure 1: The BK Energia Itacoatiara Plant generating renewable electricity from wood waste

Measures taken for GHG emission reductions are:

(1) to generate electricity for the Itacoatiarian grid (in scope) and the sawmill (out of scope) by renewable wood substituting fossil fuels.

(2) to dispose the wood waste in a useful manner by incinerating it instead of putting it on a landfill and leaving it for decay and composting.

Brief description of the installed technology and equipment:

The power plant uses direct combustion technology, the most widely known option for electricity generation and/or heat production from biomass. It burns biomass with excess air and produces steam. The steam is used to produce electricity in a Rankine cycle (a heat engine with a vapour power cycle). It consists of a high pressure boiler and a multiple stage condensing steam turbine coupled with a 9 MWel generator. The project replaces diesel generation and covers part of the electricity demand in the city of Itacoatiara.

Relevant dates for the project activity:

The starting date of operation: 01/11/2002. Continuing operation since then.

[1] The Forest Stewardship Council (FSC®, www.fsc.org) is an international certification system for environmentally and socially responsible forest management. For certificate see: http://info.fsc.org/details.php?id=a0240000005sWLpAAM&type=certificate (accessed on June 22, 2020)

Registration date of the project activity:	12/05/2006
Renewal Date:	27/01/2017
1st CDM Crediting Period:	01/11/2002 – 31/10/2009
2nd CDM Crediting Period:	01/11/2009 – 31/10/2016
3rd CDM Crediting Period:	01/11/2016 – 31/10/2023
15th CDM Monitoring Period:	01/01/2020 – 31/12/2020

Actual GHG emission reductions in this monitoring period: 40,776 t CO_2e

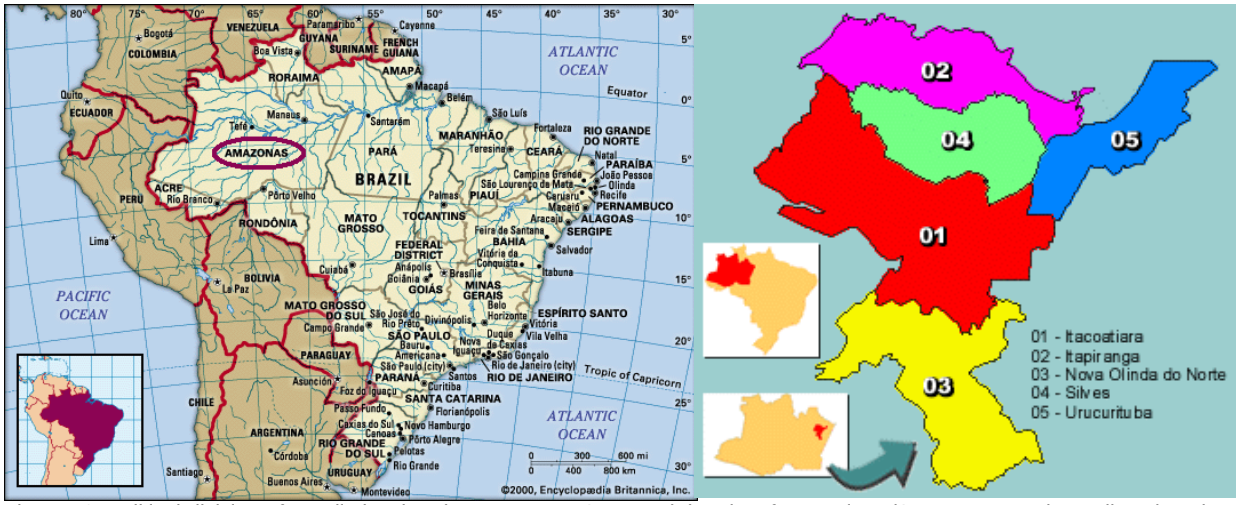
A.2. Location of project activity

>>

The project is located in the north region of Brazil, state of Amazonas, municipality of Itacoatiara, which is a city with 78,425 inhabitants and 8,892 km² of territorial extension (IBGE, 2004).

Geographical coordinates are: latitude 03º 03' 13" South, longitude 58º 43' 49" West (Coordinates of Generator/Turbine).

The city is located at the bank of the Amazon River, 240 kilometres east of Manaus, the capital of the state of Amazonas (see below).



Figures 2: Political division of Brazil showing the Amazonas State and the city of Itacoatiara (Sources: Encyclopaedia Britannica, 2003 and City Brazil, 2005)

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	**Private entity:** BK Energia Itacoatiara Ltda.	No
Switzerland	**Private entity:** Precious Woods Holding Ltd.	No
Switzerland	**Private entity:** myclimate – The Climate Protection Partnership	No

A.4. References to applied methodologies and standardized baselines

>>

Component 1, electricity-generation:

- AMS - I.D – Grid connected renewable electricity generation (version 18)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)
- Project and leakage emissions from biomass (version 2.0).
- Tool to calculate the emission factor for an electricity system (version 05.0)

Component 2, methane-emissions-avoidance:

- AMS-III.E. – Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment (version 17)
- Emissions from solid waste disposal sites (version 07.0)
- Attachment C of appendix B - General guidance on leakage in biomass project activities, version 03.
- Procedures for Renewal of the crediting Period of a Registered CDM Project Activity and its Annex 1
- Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 3.0.1).
- Project and leakage emissions from transportation of freight version 01.1.0

A.5. Crediting period type and duration

>>

1st Crediting Period: 01/11/2002 – 31/10/2009

2nd Crediting Period: 01/11/2009 – 31/10/2016

3rd Crediting Period: 01/11/2016 – 31/10/2023

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

>>

The starting date of operation was 01/11/2002.

Wood waste from the adjacent saw mill or from other demonstrably renewable sources is fed into the boiler on a conveyor belt. The boiler burns biomass with excess air and produces steam. The steam is used to produce electricity in a Rankine cycle (a heat engine with a vapour power cycle). It consists of a high pressure boiler (42 bar – 420° C) and a multiple stage condensing steam turbine coupled with a 9 MW_{el} generator. The project replaces diesel generation and covers part of the electricity demand in the city of Itacoatiara.

The remaining ash is dumped in a waste-site closed by. The boiler water is treated as well as the discharged water. The exhaust is cleaned by a multi-cyclone.

Specification of components and measurement equipment follows:

- Turbine manufactured by Dresser-Rand, model ET1HB7, serial number ET-103, rated capacity 9,000 KW_{el} (10,000 KVA) at 5,000 rpm;
- Boiler manufactured by Equipalcool, model 45 V-2-S, serial number 059-01, feed water temperature 105 ^oC, rated capacity 45,000 kg/h of steam at 42 kgf/cm^2 and 420 ^oC, biomass residues (wood chips) fuelled, LHV efficiency 85.48% (taken from technical documentation from manufacturer[2], insignificantly different from PDD (85,7%);

[2] Change approved by the CDM EB in monitoring report (period 01/01/2012 – 31/12/2012).

http://cdm.unfccc.int/Projects/DB/TUEV-SUED1134136803.71/CP/TPRZIGFRMI3RQCQP54BWEHNZI83S02/iProcess/TUEV-SUED1361174337.46/view

- Electrical generator manufactured by Toshiba, type TABL RCC, serial number 0110371000, rated capacity 10,000 kVA at 13.8 kV, 60 Hz;
- Scale 1 (the one used to weight the total of wood waste entering the boiler) manufactured by Toledo, model 9270, Maximum capacity 50t/h; serial number 02092000083, precision class 0.02%;
- Scale 2 (the one used to weight wood waste coming from outside) manufactured by Toledo, model 820, Capacity 60t, Precision Class III[3];
- One emergency diesel generator, manufactured by Caterpillar, Model 3412, Installed Capacity 545 kW.
- Small treatment facilities for boiler water and waste water.

Description of the actual operation

1. The actual operation of the project activity during this monitoring period was normal for a power plant based on biomass fuel in this age. No exchange of the equipment mentioned above was necessary. Forced by the Brazilian Electricity Regulatory Agency ANEEL, the metering system for Electricity export/import to/from the local grid had to be changed (see below in B.2.3).

   Regular overhaul times are approximately once a year with correspondent downtimes in 2020[4]:

   (1) from 01/01/2020 to 01/04/2020 (contributed to increased import of power)

   (2) from 08/02/2020 to 08/02/2020 (contributed to increased import of power)

   (3) from 27/02/2020 to 27/02/2020 (contributed to increased import of power)

   (4) from 20/06/2020 to 20/06/2020 (contributed to increased import of power)

   (5) from 08/08/2020 to 08/08/2020 (contributed to increased import of power)

   (6) from 24/08/2020 to 31/08/2020 (contributed to increased import of power)

2. The following special events occurred in 2020 (defined as longer than 12hrs with no export of power):

   1) Stop 30/03/2020, 12h00am; Resume 30/03/2020 01h17pm: Mechanical maintenance

   2) Stop 25/04/2020, 04h22am; Resume 25/04/2020 05h34pm: Mechanical maintenance

   All internal downtimes (also the many shorter ones) result in the use of the diesel backup generator and, if this is not sufficient, also the import of power from the grid. Import power is needed to operate the electrical equipment of the saw mill MIL and of BK Energia (pumps, valves, control systems, conveyor belts and in particular hogs for grinding the wood from the sawmill). As there is no separate metering between the import for the saw mill MIL and the import of BK Energia, all imported power is subtracted from the exported electricity in order to calculate net electricity for the ERs.

3. No events or situations occurred during the monitoring period, which may impact the applicability of the methodology.

4. No request for prior approval by the Board of changes to the registered CDM project activity has been submitted during this verification, in accordance with the project cycle procedure. However, there was a request for permanent changes from registered monitoring plan before this verification (see B.2.3.).

[3] Precision Class for this type of equipment is defined by the National Institute of Metrology - INMETRO (from the Portuguese *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial). Cf. INMETRO's Directive #236 dated 22/12/1994.*

[4] Source, see relevant excel sheets , disponibilidade 2020.xlsx, submitted to the DOE for Verification

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

>>

A deviation from the registry project was occurred during the months of January of the monitoring period an small amount of an external biomass - 27.240 tons - was used during these months from the Comercio Metodo Engenharia SA. The reason for the use of external biomass was because of the need of the requesting company to dispose of the waste in a safe and sustainable way.

To avoid the inclusion of external biomass, the same amount was not accounted from the total biomass weight in 2020. The proposed alternative monitoring arrangements applies a discount factors to the calculations. This factor is based on paragraph 231 point b.ii) of the Standard CDM project standard for project activities (version 02.0), a 10% will de discount of the electricity generated in 2020 as conservative assumptions, this values will impact in the overall results of the parameters

- $EG_{PJ, facility,,y}$ (quantity of net electricity generation supplied by the project plant/unit to the grid),
- $EG_{Export\ y}$ (Quantity of electricity export to the grid) and
- The total energy generated.

The monitoring of the external source is included in the parameter W_x - total amount of organic waste prevented from disposal, the external biomass was measured with the scale 2 (manufactured by Toledo, model 820, Capacity 60t, Precision Class III12; serial number #03077001065) following the guidelines describes for the parameter W_x.

The used of external source was checked for the DOE during the site visit as described in the verification report.

B.2.2. Corrections

>>

Not applicable.

B.2.3. Changes to the start date of the crediting period

>>

Not applicable.

B.2.4. Inclusion of monitoring plan

>>

Not applicable.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

>>

As described in paragraphs 238 and 239 of the CDM standard for project activities version 02.0, if project participants are unable to implement the procedures of measurements of some parameters shall apply conservative assumptions but as it is explained the parameters have not a direct effect in the GHG emission reductions and only are been used for crosschecking. ,

The parameter MC_y (average moisture content of the biomass -wet basis) is not measured as described in PDD, one sample per month (12 samples in total), but BK took three samples (during the months of January, February and March 2018) randomly from the feed-in conveyor belt of wood residues into the boiler

(homogeneous quality) instead of 12 samples. The nature of the non-conforming monitoring is the less number of samples collected for parameter MC_y during 2018, but it does not mean the reduction of quality of data as the values found keep relation with the laboratory tests performed in the previous crediting period. In addition, the extent in the non-conforming monitoring is only for crosschecking purposes; there is no an impact in emission reductions calculated. The parameter MC_y is used to estimate the theoretical efficiency of the biomass used and electricity generated and there is no impact in the emission reductions calculation.

The laboratory tests were conducted for the parameter MC_y but the change is about the number of samples gathered, 3 instead of 12, but results of the tests (36.00%) are similar as the ones conducted in 2nd crediting period (35.92%). As it is explained in the PDD the value of the parameter is only used for a cross-check and not for emission reduction estimation.

According the appendix 'Indicative list of post-registration changes that may be suitable for approval under the issuance track of the CDM standard for project activities version 02.0' the deviation fall under:

(c) Changes to the monitoring of a registered CDM project activity that have no material impact on the applicability of the applied methodologies or the other applied methodological regulatory documents, or the accuracy and completeness of the monitoring.

→ *The reported GHG emission reductions are free from material errors, omissions or misstatements as the change in the number of samples for the parameter MC_y does not affect the emission reduction estimation.*

(d) Changes to the project design of a registered CDM project activity that does not adversely impact any of the following:

(i) The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered;
(ii) The additionality of the project activity;
(iii) The scale of the project activity

→ *The methodology has been apply as written in the PDD, the change only affects a parameter that is use for crosscheck and the values found in the samples collected are roughly the same as calculated in second crediting period.*
The additionality has not been affect as the same procedures has been follow, no change in factors that change the evaluation of the additionality has been produced.
The scale of the project activity is the same; the change in the number of samples collected does not affect the scale of the project.

To follow conservative assumptions or discount factors, it is used as reference the paragraph 231 point b.ii) of the Standard CDM project standard for project activities (version 02.0), a 10% will be discounted for the values collected with the laboratory test. The value used for this parameter is 32.40%, despite there is no impact in the emission reductions calculation; it is used to crosscheck the theoretical efficiency of the electricity generated using biomass.

The parameters $NCV_{biomass\ dry}$ (average net calorific value of dry biomass) is not measured as described in PDD, 3 samples are measured quarterly (thus 12 values in total), but BK took four samples (in May 2018) randomly from the feed-in conveyor belt of wood residues into the boiler (homogeneous quality) instead of 12. The nature of the non-conforming monitoring is the less number of samples collected for parameter $NCV_{biomass\ dry}$ during 2018, but it does not mean the reduction of quality of data as the value found keep relation with the laboratory tests performed in the previous crediting period. In addition, the extent of the non-conforming monitoring is only for crosschecking purposes, there is no an impact in the emission reductions calculated as it depend on other parameter monitored. The parameter $NCV_{biomass\ dry}$ is used to estimate the theoretical efficiency of the biomass used and electricity generated and there is no impact in the emission reductions calculation.

The laboratory tests were conducted to the parameter $NCV_{biomass\ dry}$ but the change is about the number of samples gathered, 4 instead of 12, but results of the tests (19.05) are similar as the ones conducted in 2nd crediting period (19.30). As it is explained in the PDD the value of the parameter is only used for a cross-check and not for emission reduction estimation.

According the appendix 'Indicative list of post-registration changes that may be suitable for approval under the issuance track of the CDM standard for project activities version 02.0' the deviation fall under:

(c) Changes to the monitoring of a registered CDM project activity that have no material impact on the applicability of the applied methodologies or the other applied methodological regulatory documents, or the accuracy and completeness of the monitoring.

→ The reported GHG emission reductions are free from material errors, omissions or misstatements as the change in the number of samples for the parameter $NCV_{biomass\ dry}$ *does not affect the emission reduction estimation.*

(d) Changes to the project design of a registered CDM project activity that does not adversely impact any of the following:

(i) The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered;
(ii) The additionality of the project activity;
(iii) The scale of the project activity

→ The methodology has been apply as written in the PDD, the change only affects a parameter that is use for crosscheck and the values found in the samples collected are the roughly same as calculated in second crediting period.
The additionality has not been affect as the same procedures has been follow, no change in factors that change the evaluation of the additionality has been produced.
The scale of the project activity is the same; the change in the number of samples collected does not affect the scale of the project.

To follow conservative assumptions or discount factors, it is used as reference the paragraph 231 point b.ii) of the Standard CDM project standard for project activities (version 02.0), a 10% will be discounted for the values collected with the laboratory test. The value used for this parameter is 17.14, despite there is no impact in the emission reductions calculation; it is used to crosscheck the theoretical efficiency of the electricity generated using biomass.

Reference numbers of the post-registration changes: PRC-0168-004
Effective approval date: 01 Aug 19

B.2.6. Changes to project design

>>

Not applicable.

B.2.7. Changes specific to afforestation or reforestation project activity

>>

Not applicable.

SECTION C. Description of monitoring system

>>

All relevant monitoring data of the project is monitored and cross-checked: The BK internal procedure determines the monitoring details and responsibilities of the staff. All monitored data is archived on-site and is available and sent to DOE for verification. There is no fossil fuel used in the biomass boiler.

For component 1, renewable electricity generation:

According to AMS-I.D., the monitoring shall consist of metering the net electricity generated by the renewable technology.

In this annual monitoring report the export and import is aggregated and the net electricity supply to the grid calculated.

The buyer of the electricity, at present the local utility *Eletrobras Amazonas Energia S/A*, measures continuously the export to and import from the grid with power meters (precision class 0.2 corresponding to a maximum permissible error of +/-0.2%). According to the Brazilian legislation[5] electricity shall be metered by the utility. Therefore, the calibration of the instruments is carried out by the utility. However, the BK internal procedure ensures calibration at least every 3 years to be compliant to methodology (it is crucial to mention that the frequency of calibration of power meters based on the meter provider has been extend to 5 years since the current monitoring report). The operational data acquisition system SCD (from the Portuguese '*Sistema de coleta de dados operacionais*') from Enerwatt is connected to main and back up electricity meters and records electricity export and import data every 5 minutes. Data stored in SCD is used as reference for the Emission Reduction calculation. For cross-checking, the operator in the control room records manually every day at midnight the meter values. The plant manager double checks manually written export/import values the next day in SCD. On a monthly base, BK Energia issues an invoice with the records for exported electricity to Eletrobras Amazonas Energia S/A, who does the payment.

To cross-check electricity generation, also the quantity of biomass consumed is monitored (for details see section E.1. below): (a), wood waste from the saw mill MIL and (b), wood waste from the forest (road clearing, harvesting) or other saw mills. The biomass residues used in the power plant are weighted by the buyer BK Energia and checked by the seller MIL. Theoretical electricity output is calculated through multiplying the energy input (biomass) with the electrical plant efficiency

The emission factor of the grid is determined considering the electricity generated and diesel oil consumed by the plants connected to the local/regional grid as informed by the local utility. As required by the methodology, data from the period in which the electricity generated by the project plant was dispatched to the grid is used.

BK Energia measures continuously with an electronic supervisory system (GESTAL) the amount of electricity consumed internally and sold to saw mill MIL. This data is aggregated and recorded at least monthly. The system keeps historical data that can be accessed when necessary.

The following diagram shows the interconnection of the different measurement systems including the transmission line and the grid:

[5] Brazilian Electricity Regulatory Agency – ANEEL (from the Portuguese *Agência Nacional de Energia Elétrica*), Resolution #344, dated 25/06/2002. National Power System Operator – ONS (from the Portuguese *Operador Nacional do Sistema*) & Wholesale Market for Electric Power – MAE (from the Portuguese *Mercado Atacadista de Energia Elétrica*), Measurement system for electricity billing: Technical Specification (2002).

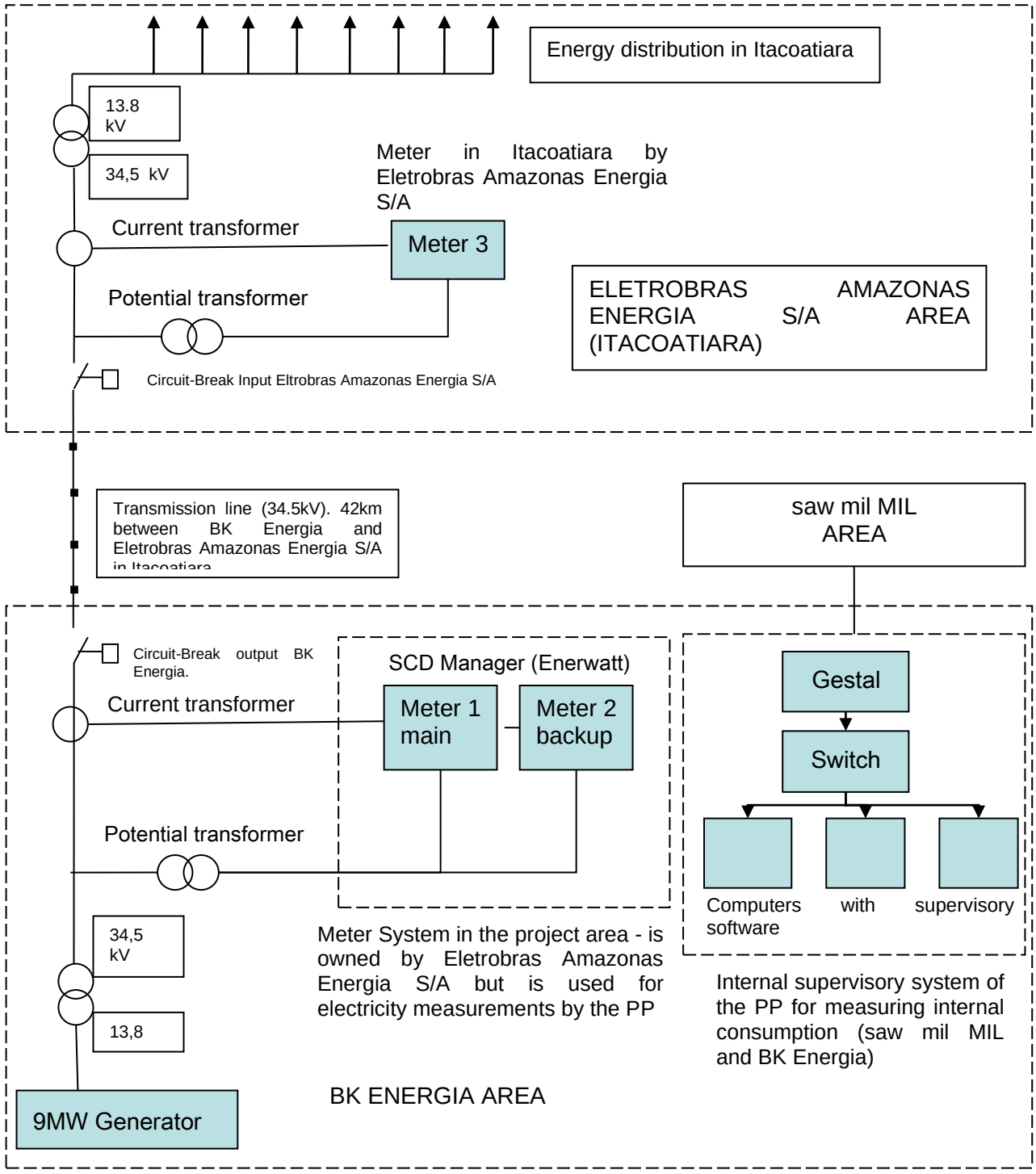


Figure 4: Simplified circuit diagram of the electricity system

For component 2, methane avoidance :

According to AMS-III.E. (V16), 28, *"The amount of waste combusted […] by the project activity in each year (Qy) shall be measured and recorded, as well as its composition through representative sampling.* Sampling is not necessary, because the biomass contains 100% wood waste[6].

The measuring and recording of the biomass combusted is the following: Scale 1 measures continuously and records all biomass entering the boiler of BK Energia. It is aggregated annually in this monitoring report.

However, for methane avoidance only the biomass can be accounted which is wood waste from the saw mill MIL. This waste would be otherwise left for anaerobic decay in a solid waste disposal site. The other wood waste coming from the forest (road clearing, harvesting) would be otherwise left for aerobic decay in the forest. If biomass originates from other saw mills, the waste disposal scenario is unknown and thus not accounted here. Hence, the biomass coming from the outside by truck is weighed on the Scale 2, which is designed for this purpose. Data is recorded and stored. Scale 2 is also periodically calibrated at least every three years[7] to ensure the correct measurement.

Finally, for methane avoidance the amount of biomass from the sawmill MIL and other external sources is determined as the difference between the total biomass entering the boiler (scale 1) and the total biomass from external sources (scale 2).[8] During this Monitoring Period no wood waste came from outside, the only Biomass source was the saw mill MIL.

The following graph is showing the flow explained above:

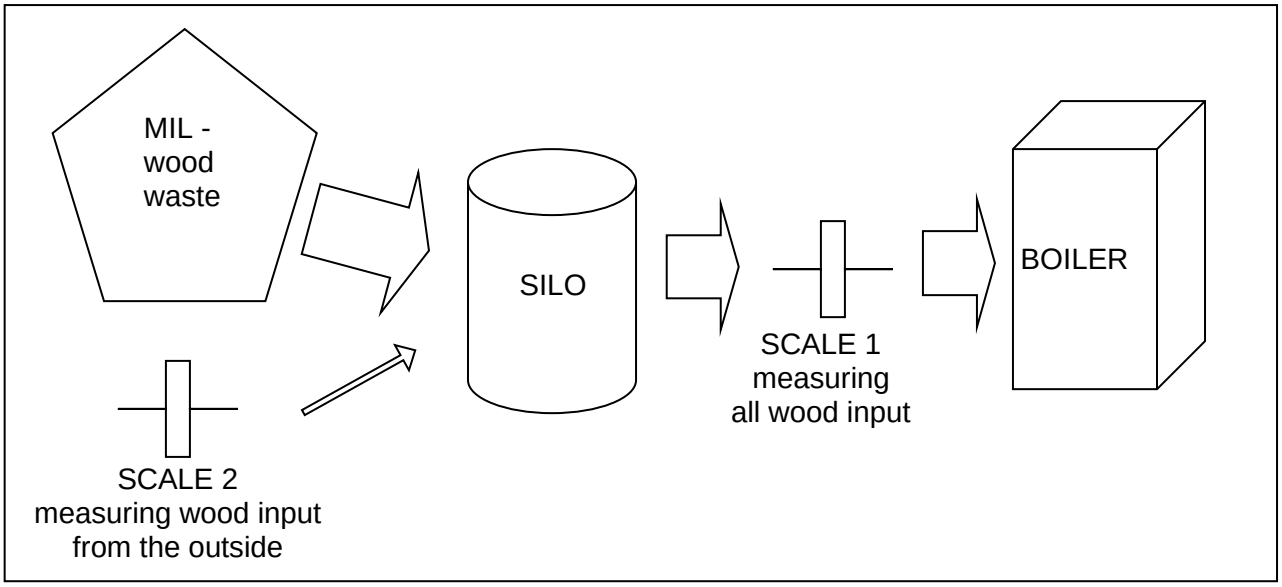


Figure 2: Flow and measuring points for the wood waste/ biomass.

According to the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 5.1.0), monitoring involves an annual assessment of the conditions at the solid waste disposal sites (SWDS) where the waste would in the absence of the project activity be dumped. This SDWS is next to the sawmill MIL (see map in PDD). The site is visually inspected during the verification audit.

---

[6] Only fresh processed biomass (wood chips and sawdust) are used as fuel, no rotting biomass. Rotting biomass has distinctive color and odor and, if found in any delivered load, the whole load is not accepted and disposed.

[7] According to the instructions presented in the Annex 14 of the 54th CDM Executive Board Meeting "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".

8 This is in line with the EB recommendations related to the request for deviation raised in the context of the last verification of the first crediting period (I-DEV0332).Available at http://cdm.unfccc.int/Projects/deviations/40206.

According to § 28 of AMS-III.E., the common practices at proximate waste disposal sites were assessed in order to find out what percentage of the amount of waste combusted in the project activity facility would have been disposed in a solid waste disposal site without methane recovery in the absence of the project activity and would decay anaerobically in the disposal site throughout the crediting period.

A request for Clarification to the SSC-WG was raised in order to specify how to conduct this assessment. It was answered as follows:
"In response to this query requesting clarification on the monitoring requirements related to baseline biomass waste disposal, under AMS-III.E, the SSC WG agreed to clarify that paragraph 28 of AMS-III.E (version 16) does not imply that the baseline scenario is to be re-evaluated annually, and thus there is no need to monitor or reassess the baseline, which was validated at the time of registration or renewal of the crediting period.
The SSC WG would like to clarify that, this paragraph is applicable to those project activities for which it was demonstrated during validation that the newly generated waste treated in the project activity would have been disposed of at two or more distinct destinations or applications (e.g. procured by third parties, disposed in sites with distinct MCF values, used in agricultural applications, etc.). For these cases, the fraction of the waste treated by the project activity that would have been sent to each identified baseline application/destination, shall be determined and justified throughout the crediting period."

The newly generated wood waste used by the project activity comes directly by conveyor belt from the saw mill MIL. In absence of the project activity this wood waste would be disposed in the landfill around the saw mill as described and justified in the PDD (A.2. and B.2, B.3., B.4 etc.). Hence, there is only one destination for the newly generated waste. As the SSC WG considers §28 only applicable for two or more distinct waste destinations, no further assessment are considered necessary by the PPs.

Wood waste that could come from external sources (road clearing in the forest, other suppliers) would go to other destinations in the absence of the project activities. However, this waste stream is excluded from ERs acc. to AMS-III.E (cf. PDD section B.7.3., page 45), therefore it does not to be evaluated acc. to AMS-III.E §28.

For the project emissions:

According to AMS-III.E. (1) the quantity of combustion residues ($Q_{y,ash}$), (2) the average truck capacity ($CT_{y,ash}$), (3) the average distance for residues transportation (DAF_{ash}) and (4) the quantity of diesel combusted in the backup diesel generator of BK Energia ($EC_{PJ,y}$) (5) the quantity of biomass residue transported from other source to BK Energy ($Q_{y,biomass2}$) and (6) average truck capacity for biomass residues transportation from other source to BK Energy ($CT_{y,biomass2}$) shall be monitored as sources of project emissions.

The total quantity of the combustion residues (wood ash) transported from the project site to its final disposal site is measured using scale 2 and recorded. For monitoring, the total quantity is aggregated annually as well as the average truck load.

The quantity of electricity generated by the backup diesel generator for BK is determined either by electricity meter, by monitored hours or by the quantity of diesel consumed (and then calculated). For this Monitoring Period the first option, quantity of diesel consumed, has been chosen because the purchased amount of Diesel is lower than the consumed, therefore the bigger consumed amount is applied to be conservative.

All necessary procedures to monitor emission reductions and any project emissions generated by the project activity are actually part of the business-as-usual procedures of the project, therefore no extra operational and management structures are necessary.

Information about the organizational structure:

BK Energias' general procedure number 10, explains the roles and responsibilities of all persons involved in the Monitoring Process. An organigram explains the responsibilities on the company level. All data is provided and checked by DOE at verification.

The whole power plant is continuously supervised by at least one person sitting in the control room, where all monitoring information comes together over electronic information systems.

In case of emergency an alarm is given by the system and the operator in charge will do the necessary adjustment to the system. If a trip level is exceeded, the plant or the relevant section is switched off automatically. If any device needs to be fixed or maintained, the operator alerts the relevant person for maintenance and repair.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	$\Phi_{default}$
Unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Emissions from solid waste disposal sites (version 07.0)
Value(s) applied	0.85
Choice of data or measurement methods and procedures	For project or leakage emissions: $\varphi_{default} = 1$. For baseline emissions: refer to the table below to identify the appropriate factor based on the application of the tool (A or B) and the climate where the SWDS is located. **Default values for the model correction factor** Humid/wet conditions / Dry conditions Application A: 0.75 / 0.75 Application B: 0.85 / 0.80 The climatic conditions at the SWDS site (Itacoatiara, State of Amazonas) are humid equatorial. http://www.brcactaceae.org/climate.html Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex ante and ex post estimation of emissions. These project activities may apply the simplified approach detailed in 0 when calculating baseline emissions.
Purpose of data/parameter	Baseline Methane Avoidance Calculation
Additional comments	The table above is applicable to Option 1 in the procedure "Determining the model correction factor (φ_y)"

Data/Parameter	**OX**
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or measurement methods and procedures	0.1 is used for managed and unmanaged solid waste disposal sites.
Purpose of data/parameter	Baseline Methane Avoidance Calculation
Additional comments	

Data/Parameter	**F**
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)

Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or measurement methods and procedures	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Purpose of data/parameter	Baseline Methane Avoidance Calculation
Additional comments	

Data/Parameter	DOC_j
Unit	-
Description	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data	Fraction of degradable organic carbon in the waste type *j (*weight fraction)
Value(s) applied	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Choice of data or measurement methods and procedures	0.43
Purpose of data/parameter	Baseline Methane Avoidance Calculation.
Additional comments	

Data/Parameter	**MCF**
Unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.36
Choice of data or measurement methods and procedures	As discussed in detail in section B.4 in the CDM-DD, the methane correction factor for open stockpiling only is chosen in order to follow the strict conservative approach as requested by the DOE. Waste disposal procedures and methods of MIL prescribe the necessary processes to be compliant with the FSC certification standard.
Purpose of data/parameter	Baseline Methane Avoidance Calculation.
Additional comments	If the PP can show further evidence that the disposal practice for the wood waste in case of absence of the project activity would qualify as an "unmanaged-shallow solid waste disposal" or another type of waste disposal site as defined in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", the applied value for MCF shall be adjusted accordingly.

Data/Parameter	k_j
Unit	1/yr
Description	Decay rate for the waste type *j*
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3).

Value(s) applied	0.02
Choice of data or measurement methods and procedures	As discussed in detail in section B.4, the decay rate k_j for open stockpiling only is chosen in order to follow the strict conservative approach as requested by the DOE. Therefore in accordance with paragraph 29 of the AMS-III.E.. (V17), the lower value from the range for the Boreal and Temperate Climate Zones provided in the IPCC 2006 Guidelines was used. If the PP can show more evidence that the disposal practice for the wood waste in case of absence of the project activity would qualify as an "unmanaged-shallow solid waste disposal" or another type of waste disposal site as defined in the Tool "Emissions from solid waste disposal site", the applied value for **k_j** shall be adjusted accordingly. The climatic conditions at the SWDS site (Itacoatiara, State of Amazonas) are MAT>=20ºC (Tropical region), MAP>1000 mm (1,923 mm/year, wet region) and PET = 1,523 mm/year (MAP/ PET >1). Information from EMBRAPA Climatologic Database of Brazil (http://www.bdclima.cnpm.embrapa.br/resultados/balanco.php?UF=&COD=6).
Purpose of data/parameter	Baseline Methane Avoidance Calculation.
Additional comments	

Data/Parameter	$EF_{CO2,f}$
Unit	g CO_2/t km
Description	Default CO_2 emission factor for freight transportation activity f
Source of data	Default values from the methodological tool Project and leakage emissions from transportation of freight Version 01.1.0
Value(s) applied	245 for light vehicles (vehicles with a gross vehicle mass being less or equal to 26 tonnes) 129 for heavy vehicles (Vehicles with a gross vehicle mass being higher than 26 tonnes)
Choice of data or measurement methods and procedures	Applicable to Option B. The default CO2 emission factors take into account emissions generated by loaded outbound trips and empty return trips. The default emission factors have been obtained from two sources. For light vehicles, the emission factor was obtained from empirical data from European vehicles.4 For heavy vehicles, the emission factor has been derived based on custom design transient speed-time-gradient drive cycle (adapted from the international FIGE cycle), vehicle dimensional data, mathematical analysis of loading scenarios, and dynamic modelling based on engine power profiles, which, in turn, are a function of gross vehicle mass (GVM), load factor, speed/acceleration profiles and road gradient. The following assumptions on key parameters have been made: an average driving speed of 30 km/h, an average gradient of 1%, and a load factor attained when biomass5 is transported were assumed

Purpose of data/parameter	Project Emission Calculation
Additional comments	The data used is in accordance with the paragraph 19 of AMS-III.E. Diesel EF: 74,100 kg CO_2/TJ (2006 IPCC Guidelines) Diesel NCV: 10,100 kcal/kg (BEB, Annexes, Page 224) Diesel density: 840 kg/m^3 (BEB, Annexes, Page 224) Resulting in: Diesel EF = 0.003 tCO_2e /litre 0.003 tCO_2e /litre of diesel, with a maximum consumption of 40 litres of diesel per 100 km, for diesel heavy trucks, 0.001 t CO_2/km.

D.2. Data and parameters monitored

Data for component 1, renewable electricity generation

Data/Parameter	$EG_{PJ,\ facility,,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Measured/calculated/default	Calculated
Source of data	Emission Reduction excel spreadsheet
Value(s) of monitored parameter	48,979.856
Monitoring equipment	Not applicable since it is a calculated parameter; for further details see parameters $EG_{export,y}$ and $EG_{import,y}$
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	Calculation based on the subtracting import from export amount.
QA/QC procedures	Not applicable since it is a calculated parameter; for further details see parameters $EG_{export,y}$ and $EG_{import,y}$
Purpose of data/parameter	Baseline Calculation, Electricity Component
Additional comments	A discount factor of 10% is used in the data for 2020 because the use of external biomass (conservative approach).

Data/Parameter	$EG_{Export\ y}$
Unit	MWh/y
Description	Quantity of **electricity export** to the grid in the monitoring period y
Measured/calculated/default	Measured
Source of data	Eletrobras Amazonas Energia S/A meters, SCD
Value(s) of monitored parameter	49,061.964

Monitoring equipment	The meter models are PowerLogic ION8650 from Schneider Electric (precision class 0.2 corresponding to a maximum permissible error of +/- 0.2%), Serial Number MW-1709A594-02 (main meter) and PT1012A440-01 (backup meter for cross-checking); Calibration at least every 3 years, but based on the exchanges communication with the power meter provider (ENERWATT) – which is the entity that released the calibration certificate - it is clearly stated that based on Brazilian regulations the calibration is done every 5 years (since the last regulation from ONS since 2017). The main meter had the factory calibration certificate on 20 November 2017, valid until 19/11/2022 (verified by the DOE during document review and on-site visit) which cover the current monitoring period. Last 2 calibrations executed for backup meter on 04/11/2015 valid until 03/11/2018 and on 10/09/2018 valid until 09/09/2023 (verified by the DOE during document review and on-site visit). Meters connected to SCD. According The National Institute of Metrology, Quality and Technology (INMETRO) meters are calibrated every 5 years. INMETRO decree number 431, December of 2007. According to National Electrical System Operator (ONS) document Sub-module 12.3 Maintenance of the measurement system for billingpoint 5.1.2.2 the calibration of the meters must occur every 5 (five) years. 1 January 2017.
Measuring/reading/recording frequency	Measured continuously, recorded every 5 minutes in SCD, aggregated monthly.
Calculation method (if applicable)	n/a
QA/QC procedures	Energy metering QA/QC procedures are explained in section B.7.2 of the CDM-DD, cf. internal procedures # 4 and #5. As there is no any guidelines in the methodology AMS I.D version 18 or in the tool to calculate the emission factor for an electricity system version 05.0 or in the general guidelines for SSC CDM methodologies version 22.0 about the period of calibration, the parameter will follow the next rules: Instructions presented in the Annex 14 of the 54th CDM Executive Board Meeting - "*Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*" - equipment used to monitor this parameter will be periodically calibrated at least once in 3 years, cf. (it is crucial to mention that the frequency of calibration of power meters based on the meter provider has been extend to 5 years) internal procedure # 8 for the calibration of scales and power meters and instruction presented in the CDM project standard version 9.0, project participants or the coordinating/managing entity shall ensure that the equipments are calibrated either in accordance with the local/national standards, or as per the manufacturer's specifications. If local/national standards or the manufacturer's specifications are not available, international standards may be used, The calibration of measuring equipments shall be carried out by an accredited person or institution.
Purpose of data/parameter	Baseline Calculation, Electricity Component
Additional comments	A discount factor of 10% is used in the data for 2020 because the use of external biomass (conservative approach). Official statement of meter provider ENERWATT about the calibration frequency is delivered to DOE during verification.

Data/Parameter	$EG_{Import\ y}$
Unit	MWh/y
Description	Quantity of **electricity import** from the grid in the monitoring period y

Measured/calculated/default	Measured
Source of data	Eletrobras Amazonas Energia S/A meters, SCD
Value(s) of monitored parameter	82.108
Monitoring equipment	The meter models are PowerLogic ION8650 from Schneider Electric (precision class 0.2 corresponding to a maximum permissible error of +/- 0.2%), Serial Number MW-1709A594-02 (main meter) and PT1012A440-01 (backup meter for cross-checking); Calibration at least every 3 years, but based on the exchanges communication with the power meter provider (ENERWATT) – which is the entity that released the calibration certificate - it is clearly stated that based on Brazilian regulations the calibration is done every 5 years (since the last regulation from ONS since 2017). The main meter had the factory calibration certificate on 20 November 2017, valid until 19/11/2022 (verified by the DOE during document review and on-site visit) which cover the current monitoring period. Last 2 calibrations executed for backup meter on 04/11/2015 valid until 03/11/2018 and on 10/09/2018 valid until 09/09/2023 (verified by the DOE during document review and on-site visit). Meters connected to SCD. According The National Institute of Metrology, Quality and Technology (INMETRO) meters are calibrated every 5 years. INMETRO decree number 431, December of 2007. According to National Electrical System Operator (ONS) document Sub-module 12.3 Maintenance of the measurement system for billingpoint 5.1.2.2 the calibration of the meters must occur every 5 (five) years. 1 January 2017.
Measuring/reading/recording frequency	Measured continuously, recorded every 5 minutes on SCD, aggregated monthly.
Calculation method (if applicable)	n/a
QA/QC procedures	Energy metering QA/QC procedures are explained in section B.7.2 of the CDM-DD, cf. internal procedures # 4 and #5. As there is no any guidelines in the methodology AMS I.D version 18 or in the tool to calculate the emission factor for an electricity system version 05.0 or in the general guidelines for SSC CDM methodologies version 22.0 about the period of calibration, the parameter will follow the next rules: Instructions presented in the Annex 14 of the 54th CDM Executive Board Meeting - "*Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*" - equipment used to monitor this parameter will be periodically calibrated at least once in 3 years, cf. (it is crucial to mention that the frequency of calibration of power meters based on the meter provider has been extend to 5 years) internal procedure # 8 for the calibration of scales and power meters and instruction presented in the CDM project standard version 9.0, project participants or the coordinating/managing entity shall ensure that the equipments are calibrated either in accordance with the local/national standards, or as per the manufacturer's specifications. If local/national standards or the manufacturer's specifications are not available, international standards may be used, The calibration of measuring equipments shall be carried out by an accredited person or institution.
Purpose of data/parameter	Baseline Calculation, Electricity Component
Additional comments	So far Eletrobras Amazonas Energia S/A does not charge BK Energia for the electricity import, however, the same is deducted from the electricity export in the ER calculation. Official statement of meter provider ENERWATT about the calibration frequency is delivered to DOE during verification.

Data/Parameter	$EF_{grid,y}$
Unit	tCO_2e/MWh
Description	CO_2 emission factor of the grid electricity in year *y*
Measured/calculated/default	Calculated
Source of data	As per AMS-I.D. (V18), Footnote 2, item 2 and 3: Local Utility (electricity production and diesel consumption) IPCC 2006 Guidelines (NCV, EF of Diesel) and Brazilian Energy Balance 2020 (fuel density for transforming consumption of liters in kg, https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-479/topico-528/BEN2020_sp.pdf)
Value(s) of monitored parameter	0.777
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	The emission factor is calculated as the average emissions (in tCO_2e /MWh) of the current generation mix. The current mix of Itacoatiara grid is supplied with electricity produced by the CDM project power plant and by other power plant fuelled with diesel oil, UTE Itacoatiara (AME). For the calculation of the emission factor the data of electricity production and diesel consumption of the diesel plant connected of the isolated Itacoatiara grid is used (confidential data, disclosed to DOE and UNFCCC). NCV and EF for Diesel oil are taken from IPCC Guidelines (see monitored data below). In order to transform the diesel consumption in volume to weight, the Brazilian diesel fuel density (0.840 kg/liter) is used.
QA/QC procedures	As per paragraph 23 of AMS-I.D. (V18) this parameter shall be determined using data of the year in which project generation occurs. Thus, it will be monitored.
Purpose of data/parameter	Baseline Calculation, Electricity Component
Additional comments	n/a

Data/Parameter	$NCV_{i,y}$
Unit	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton); IPCC: TJ/Gg
Description	Weighted average net calorific value (energy content) of fuel type i in year y
Measured/calculated/default	Default
Source of data	IPCC default value 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.
Value(s) of monitored parameter	43.3
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	AMS I.-D. paragraph 24 requests to use the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". Therefore the following data sources may be used if the relevant conditions apply:

Data source	Conditions for using the data source
a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)
b) Measurements by the project participants	If a) is not available
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
d) IPCC default values at the upper limit of the uncertainty at 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	If a) is not available

For a), b) and c) are not available, d) the IPCC default is used.

QA/QC procedures	Review appropriateness of the values annually according to CDM-PDD (specific values on invoices of fuel supplier or national default values or IPCC Guidelines if revised). Then review, result of the review was: a), b) and c) are not available, thus d) the latest IPCC (2006) default is used.
Purpose of data/parameter	Baseline Calculation, Electricity Component
Additional comments	The upper limit value (43.3) is used for project emissions and lower limit value (41.4) for baseline emissions.

Data/Parameter	$EF_{CO2,I,y}$
Unit	tCO_2e /GJ, IPCC: $kgCO_2/TJ$
Description	CO_2 emission factor of fossil fuel type i used in power unit in year y
Measured/calculated/default	Default
Source of data	IPCC default value 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
Value(s) of monitored parameter	74,800
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually

<table>
<tr><td>Calculation method (if applicable)</td><td>AMS I.-D. paragraph 24 requests to use the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". Therefore 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 Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table>
As a), b) and c) are not available, d) the IPCC default is used. :</td></tr>
<tr><td>QA/QC procedures</td><td>Review appropriateness of the values annually according to CDM-PDD (specific values on invoices of fuel supplier or national default values or IPCC Guidelines if revised). Then review, the result of the review was: a), b) and c) are not available, thus d) the latest IPCC (2006) default is used.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Baseline Calculation, Electricity Component</td></tr>
<tr><td>Additional comments</td><td>The upper limit value (74.8) is used for project emissions and lower limit value (72.6) for baseline emissions.</td></tr>
</table>

Data/Parameter	$MC_{,y}$
Unit	%
Description	Average Moisture Content of the biomass (wet basis)
Measured/calculated/default	Measured
Source of data	Analysis in laboratory according to relevant international standard (ASTM)
Value(s) of monitored parameter	32.40

Monitoring equipment	BK took during the 3rd crediting period three samples randomly from the feed-in conveyor belt of wood residues into the boiler (homogeneous quality).
Measuring/reading/recording frequency	Measuring: As per Clarification SSC_563, the moisture content was monitored on-site during the first year of the crediting period and if the project continues to use same type of biomass during the rest of the crediting period, the monitored data on moisture content referred above shall be used for the rest of the crediting period. BK took during the 3rd crediting period three samples randomly from the feed-in conveyor belt of wood residues into the boiler (homogeneous quality). Despite other external biomass sources were used, the amount represents 2.89% of the total biomass used in 2018 and it was not account for calculation, therefore no test were conducted as there is no major change in the emission reduction calculation.
Calculation method (if applicable)	The average was calculated and used[9].
QA/QC procedures	The samples were sent to a qualified laboratory and measured according to relevant international standards (ASTM).
Purpose of data/parameter	This value is not used for calculating emission reductions but just for cross-check purposes. The value was calculated as described from measurements taken during the 3rd crediting period.
Additional comments	A discount factor of 10% is considered because a change in the number of samples required as set in the PDD (conservative approach).

Data/Parameter	$NCV_{biomass\ dry}$
Unit	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton); IPCC: TJ/Gg
Description	Average net calorific value of dry biomass
Measured/calculated/default	Measured
Source of data	Analysis in laboratory (according to relevant international standard (ASTM))
Value(s) of monitored parameter	17.14
Monitoring equipment	BK takes four samples randomly from the feed-in conveyor belt of wood residues into the boiler (homogeneous quality). For conservative reasons the inferior value of the measured NCV is chosen.
Measuring/reading/recording frequency	For the first monitoring report under the 3rd crediting period, 4 samples are measured in May 2018. The average value can be used for this first report and the rest of the crediting period. BK takes four samples randomly from the feed-in conveyor belt of wood residues into the boiler (homogeneous quality). For conservative reasons the inferior value is chosen. The average value can be used for the rest of the crediting period.[10] Despite other external biomass sources were used, the amount represents 0.32% of the total biomass used in 2019 and it was not account for calculation, therefore no test were conducted as there is no major change in the emission reduction calculation.

[9] Even though the methodology AMS-I.D., version 18 mentions that „the weighted average should be calculated and used in the calculations", the "weighted average" is not different to the "simple average" in this given case since only one kind of biomass (wood waste) is used in the project activity.

[10] Monitoring Report 07 of the project

Calculation method (if applicable)	The average is calculated and used.
QA/QC procedures	For plausibility check, the Value 19 MJ/kg for Deciduous Wood from the Woodfuels Handbook[11] and the IPCC default of 15.6 TJ/Gg (within a range of 7.9 to 31.0) is taken (as provided in Table 1.2, Chapter 1, Vol. 2 of the 2006 IPCC Guidelines). The IPCC Guideline shows that there is a wide range. The Woodfuels Handbook refers to European Species, thus the measured value of 19.0 is considered as plausible. The samples were sent to a qualified laboratory and measured according to relevant international standards (ASTM).
Purpose of data/parameter	This value is not used for calculating emission reductions but just for cross-check purposes.
Additional comments	A discount factor of 10% is considered because a change in the number of samples required as set in the PDD (conservative approach).

For component 2 – methane avoidance:

Data/Parameter	**$DOC_{f,y}$**
Unit	Weight fraction
Description	Fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Measured/calculated/default	Calculated
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories Samples of parameter BMP_j
Value(s) of monitored parameter	0.05
Monitoring equipment	BK took five samples randomly from residual waste (each at least 500 g. in weight) during the months of September, October and November of 2017 and July and August of 2018.
Measuring/reading/recording frequency	Once for the first monitoring report. The value determined is valid during the crediting period.
Calculation method (if applicable)	Application B according Methodological tool Emissions from solid waste disposal sites version 07.0 $DOC_{f,y} = DOC_{f,m} = 0.7 \times \frac{12}{16} \times \frac{BMP_j}{F \times DOC_j}$
QA/QC procedures	-
Purpose of data/parameter	Baseline Methane Avoidance Calculation
Additional comments	- Once calculated, the value determined is valid during the crediting period.

Data/Parameter	BMP_j
Unit	t CH_4/t waste

http://cdm.unfccc.int/Projects/DB/TUEV-SUED1134136803.71/CP/TPRZIGFRMI3RQCQP54BWEHNZI83S02/iProcess/TUEV-SUED1361174337.46/view

[11] Attached in the folder 'Other evidences' delivered to DOE.

Description	Biochemical methane potential (BMP) of the residual waste type j disposed or prevented from disposal.
Measured/calculated/default	Measured
Source of data	Samples
Value(s) of monitored parameter	0.02
Monitoring equipment	BK took five samples randomly from residual waste (each at least 500 g. in weight) during the months of September, October and November of 2017 and July and August of 2018.
Measuring/reading/recording frequency	BK takes 5 samples for different batches.
Calculation method (if applicable)	Conduct a fermentation test on a sample of the residual waste that is at least 500 g in weight. The test should be undertaken according to a national or international standard, which may need to be adapted to conduct the test on a sample that is 500 g or more in weight. The duration of the fermentation test should be until no further methane is generated (indicating the complete conversion of BMP to methane). Take the average of the five test results.
QA/QC procedures	-
Purpose of data/parameter	Baseline Methane Avoidance Calculation
Additional comments	Five samples from different batches as part of the first monitoring report. Once calculated, the value determined is valid during the crediting period.

Data/Parameter	GWP_{CH4}
Unit	tCO_2e / tCH_4
Description	Global Warming Potential (GWP) of methane, valid for the relevant commitment Period
Measured/calculated/default	Default
Source of data	Decisions under UNFCCC and the Kyoto Protocol for second commitment period (from 1 January 2013), verified on: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
Value(s) of monitored parameter	25
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	n/a
QA/QC procedures	Revision for monitoring report – reviewed by DOE during verification
Purpose of data/parameter	Baseline Calculation, Methane Avoidance
Additional comments	n/a

Data/Parameter	**F**
Unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner

Measured/calculated/default	Measured
Source of data	Onsite information- avoided landfill thus no capture or flare technology
Value(s) of monitored parameter	0
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	n/a
QA/QC procedures	Revision for monitoring report – reviewed by DOE during verification
Purpose of data/parameter	Baseline Calculation, Methane Avoidance
Additional comments	n/a

Data/Parameter	$\mathbf{p_{n,j,x}}$
Unit	-
Description	Weight fraction of the waste type *j* in the sample *n* collected during the monitoring period *x*
Measured/calculated/default	Measured
Source of data	Onsite information
Value(s) of monitored parameter	1
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	n/a
QA/QC procedures	Since the project activity started, the waste has been always been 100% wood waste. The PP foresees no technical and waste changes. As requested per DOE, this parameter is monitored during verification. Revision for monitoring report – reviewed by DOE during verification
Purpose of data/parameter	Baseline Calculation, Methane Avoidance
Additional comments	n/a

Data/Parameter	**Z**
Unit	-
Description	Nr of samples collected during the monitoring period *x*
Measured/calculated/default	Measured
Source of data	Onsite information
Value(s) of monitored parameter	1
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	n/a

QA/QC procedures	Since the project activity started, the waste has been always been 100% wood waste. The PP foresees no technical and waste changes. As requested per DOE, this parameter is monitored during verification. Revision for monitoring report – reviewed by DOE during verification
Purpose of data/parameter	Baseline Calculation, Methane Avoidance
Additional comments	n/a

Data/Parameter	$W_X = Q_{biomass,\ fresh}$
Unit	Tonnes
Description	Total amount of organic waste prevented from disposal in year x
Measured/calculated/default	Measured
Source of data	Scale 1 with electronic supervisory system (JC Sistemas Software), Scale 2 with weighing tickets.
Value(s) of monitored parameter	Scale 1: 91,188.819 Scale 2: 27.240
Monitoring equipment	• Scale 1 (the one used to weight the total of wood waste entering the biomass boiler) manufactured by Toledo, model 9270, Maximum capacity 50t/h; precision class 0.02%; serial number 02092000083, calibration frequency is annually as stated by INMETRO, date of calibrations: certificate nº 0003670 of 31/07/2019 (valid until 30/07/2020) and certificate nº 0004068 of 07/07/2020 (valid until 06/07/2021). • Scale 2 (the one used to weight wood waste coming from outside) manufactured by Toledo, model 820, Capacity 60t, Precision Class III[12]; serial number #03077001065 calibration frequency is annually as stated by INMETRO, date of calibrations: certificate nº 0003669 of 31/07/2019 (valid until 30/07/2020) and certificate nº 0004067 of 07/07/2020 (valid until 06/07/2021). According The National Institute of Metrology, Quality and Technology (INMETRO) scales are calibrated annually. INMETRO decree number 236, 1994.
Measuring/reading/recording frequency	Measured continuously and recorded at least monthly as per the monitoring plan. A small amount of external biomass (0.03% of the total biomass used in 2020) sources were used, measure was performed with scale 2.
Calculation method (if applicable)	Calculation: Only measurements of Scale 1,measurements of Scale 2 are not take into account.
QA/QC procedures	According to the instructions presented in the Annex 14 of the 54th CDM Executive Board Meeting - "*Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*" - equipment used to monitor this parameter is periodically calibrated at least once in 3 years, cf. internal procedure # 8 for the calibration of scales and power meters.
Purpose of data/parameter	Baseline Calculation, Methane Avoidance
Additional comments	-

[12] Precision Class for this type of equipment is defined by the National Institute of Metrology - INMETRO (from the Portuguese *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial). Please refer to INMETRO's Directive #236 dated 22/12/1994.*

As the biomass contains 100% wet wood waste, no waste fractioning and sampling need to be carried out, the monitoring parameters p and z do not apply for this project. No auxiliary fuel or non-biomass fossil fuel is put into the biomass boiler, thus those parameters are not applicable.

According to 'Emissions from solid waste disposal sites (version 07.0)' the conditions at the solid waste disposal site (SWDS) where the waste would in the absence of the project activity be dumped, were assessed as follows: According to MIL/ Precious Woods management no installation for capturing and flaring or combusting gas from the SWDS was made. This was visually inspected on-site by walking around on old waste site and can be confirmed.

The assessment according to AMS-III.E. is waived as explained in section C of this MR.

For Project Emissions:

Data/Parameter	$FR_{f,m}$
Unit	Tonnes
Description	Total mass of freight transported in freight transportation activity f in monitoring period m: Quantity of combustion residues produced in the year *y* For re-validation: 1% of the total biomass residue consumed
Measured/calculated/default	Measured
Source of data	Ash disposal recordings from Scale 2 (weight and number of truckloads as per weighing tickets)
Value(s) of monitored parameter	409.162
Monitoring equipment	Scale 2 manufactured by Toledo, model 820, Capacity 60t, Precision Class III[12]; serial number #03077001065; calibration frequency is annually as stated by INMETRO, date of calibrations: certificate nº 0003669 of 31/07/2019 (valid until 30/07/2020) and certificate nº 0004067 of 07/07/2020 (valid until 06/07/2021). According The National Institute of Metrology, Quality and Technology (INMETRO) scales are calibrated annually. INMETRO decree number 236, 1994.
Measuring/reading/recording frequency	Measured per truckload of ash leaving to the waste dumping site (as of September 2010 since it became evident by re-validation that ash tonnage needs to be measured).
Calculation method (if applicable)	
QA/QC procedures	Scale 2 is used to weight the ashes leaving the plant. Whenever a truck leaves the plant it is weighted on the scale and the quantity of ashes is determined subtracting the weight of the truck. The scale is calibrated at least once in 3 years, cf. internal procedure #8 for the calibration of scales and power meters
Purpose of data/parameter	Project Emission Calculations
Additional comments	

Data/Parameter	$CT_{y,ash}$
Unit	Tonnes per truckload
Description	Average truck capacity for residues transportation

Measured/calculated/default	Measured
Source of data	Recordings from Scale 2 (Weight and number of truckloads)
Value(s) of monitored parameter	9.090
Monitoring equipment	Scale 2 manufactured by Toledo, model 820, Capacity 60t, Precision Class III[12], serial number #03077001065; calibration frequency is annually as stated by INMETRO, date of last calibrations: certificate nº 0003669 of 31/07/2019 (valid until 30/07/2020) and certificate nº 0004067 of 07/07/2020 (valid until 06/07/2021). Latest calibration valid for this Monitoring Period. Latest calibration valid for this Monitoring Period. According The National Institute of Metrology, Quality and Technology (INMETRO) scales are calibrated annually. INMETRO decree number 236, 1994.
Measuring/reading/recording frequency	Per waste truck used
Calculation method (if applicable)	Measured per truckload of ash leaving to the waste dumping site as of September 2010 (since it came evident by re-validation that ash tonnage needs to be measured).
QA/QC procedures	n/a
Purpose of data/parameter	Project Emission Calculations
Additional comments	

Data/Parameter	$D_{f.m}$
Unit	Kilometre
Description	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m: Average distance for residues transportation
Measured/calculated/default	Measured
Source of data	Measurement with Mileage Counter (cross-check verification with GPS data/ map).
Value(s) of monitored parameter	2.6
Monitoring equipment	Mileage Counter and verification with GPS data/ map
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	n/a

QA/QC procedures	Ashes generated inside the project boundary are disposed in a waste disposal site (1.3 km distance) or on farm fields (due to the fact that wood ash is a valuable organic fertilizer). The truck used with this purpose returns to the plant after depositing the ashes. In case of transporting the ash to a farm, the distance can be several kilometres. It will be measured by the mileage counter of the truck, cross-checked and correspondingly considered in the PE calculation. As the location of the BK plant was not changed and the location of the ash waste site was not changed since re-validation, the monitored value of 2.6 km is the same as stated ex-ante in the PDD and confirmed in re-validation. The value from the mileage counter was used and cross-checked with map including GPS coordinates.
Purpose of data/parameter	Project Emission Calculations
Additional comments	n/a

Data/Parameter	**$FC_{i,j,y}$**
Unit	liters per year
Description	Quantity of diesel combusted in the backup diesel generator of BK
Measured/calculated/default	Measured
Source of data	Onsite measurements (log-book, invoices)
Value(s) of monitored parameter	5,000.000
Monitoring equipment	Flow meter/ Gauge of diesel pump
Measuring/reading/recording frequency	Monthly recording of Diesel use
Calculation method (if applicable)	n/a
QA/QC procedures	Quantity of diesel used is measured by the flow meter/ gauge of the pump that pumps the diesel from the tank to the engines. It is recorded by BK in a log book summing up at 3,583.0l. As the tank has no gauge to measure its content, the recorded consumption and the purchase records can differ. The difference is the diesel still stored in the tank. Therefore diesel consumption is cross-checked with available purchase invoices from the financial records, summing up at 5,000.0l. As the conservative approach was chosen for this monitoring period, the higher value, the purchased quantity is accounted for the ER calculations.
Purpose of data/parameter	Project Emission Calculations
Additional comments	n/a

D.3. Implementation of sampling plan

>>
Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

>>

For the component 1, electricity-generation:

Description: The project activity delivers electricity to the isolated grid of the city of Itacoatiara. That electricity would have been otherwise generated operating grid-connected fossil fuel power plants (diesel generator). They provided 100% of the electricity to the city before the implementation of the project activity. Thus, the baseline scenario is electricity from fossil fuel only.

Baseline emissions (BE_y, in tCO_2e) are determined according to paragraph 19 and 22 of the AMS-I.D. methodology "The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid". Baseline emissions include only CO2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. *As the product of electrical energy baseline $EG_{BL,\ y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid factor.* Only net electricity exported to the local grid is taken into account. Electricity consumed from the grid by the plant is discounted from the electricity produced by the plant, which is exported to the grid.

Baseline emissions are estimated as follows:

$$BE_y = EG_{PJ,\ facility,y} * EF_{grid,y} \qquad \textbf{Equation 1}$$

Where,

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

$EG_{PJ,facility,y}$ = Quantity of net electricity that is produce and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh).

$EF_{grid.y}$ = Weight average emission factor of the current generation mix (tCO_2/MWh)

The net electricity shall be used to calculate emission reductions. Hence, the following formula is used:

$$EG_{PJ,facility,y} = EG_{Exporty} - EG_{Importy} \qquad \textbf{Equation 2}$$

Where,

$EG_{Exporty}$ = Quantity of electricity generated through biomass and exported to the grid in MWh in the year y

$EG_{Importy}$ = Quantity of electricity imported from the grid in MWh in the year y – and used for the project activity.

Following paragraph 23 (b) of AMS.I-D., the emission factor will be determined as: *"The weighted average emissions (in tCO_2 /MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) [reference to footnote 2] and made publicly available".*

As of today Itacoatiara remains an isolated city grid. The electricity supplied comes from the plant of the project activity and from other thermo power plants fuelled with diesel oil (UTE Itacoatiara). Therefore, the emission factor of the local electricity system is the average emissions of this plant.

Eletrobrás Amazonas Energia, which is the local power utility, supplied the monthly electricity generation and diesel oil consumption of UTE Itacoatiara[13]. Therefore this is used to calculate the weighted average emissions of the current generation mix plus data from official sources and default IPCC values.

The "weighted average emissions" of the Itacoatiara grid consisting of the one diesel fuel plant is calculated as follows (formula from the "Tool to calculate the emission factor for an electricity system", p.15, Option A1.):

$$EF_{grid,y} = EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad \text{Equation 3}$$

Where,

EFEL,m,y	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
FCi,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)
EFCO2,i,y	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
EGm,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

Data used and the calculations of the emission factor are detailed below in section B.6.3.

Cross Checking electricity generation

As per approved PDD "the measured quantity of biomass is used for cross-checking electricity generation ex post. Therefore the amount of biomass (adjusted with moisture content) is multiplied by the NCV of dry biomass and the efficiency of the energy generation of the plant. For comparison the metered total electricity shall be used."

For 2020 the metered actual electricity value is 29.67% above the calculated value, because the plant efficiency was slightly higher (20.74% in 2020 in comparison to the average efficiency used for calculation (14.59%, average over the first crediting period 2002-2016).

As wood is a natural fuel with fluctuating non-constant physical characteristics, the whole incineration process is a complex non-linear process with non-constant fluctuating outcomes and efficiencies, particularly in comparison to electricity production with natural gas or oil. Surface and humidity of the wood chips, the wood species and the decomposing degree are main factors on the fuel side; burning dynamics, fuel and air input, steam pressure development are main factors on the processing side. All those factors influence in the end the amount of produced electricity. To determine outcomes of a non-linear complex system is much more difficult than of a linear simple system with clear root-cause relationships. Hence, the metered values show a very reliable consistency of the measurements and a fairly stable management of the electricity generation process.

[13] Data supplied by Eletrobrás is confidential. In line with item 2 of footnote #2 of paragraph 23, the calculation carried out by the project participants was supplied to the DOE and the CDM-PDD only shows the resultant carbon emission factor and the corresponding list of plants.

For the component 2, methane-emissions-avoidance:

Baseline emissions (BE_y, in tCO_2e) are determined according to version 17 of the AMS-III.E. methodology by preventing the anaerobically decay of wood waste in a solid waste disposal site through controlled combustion in the thermo power plant. .

The formula used is:

$$BE_y = BE_{CH4,SWDS,y} \quad \textbf{Equation 4}$$

Where,

BE_y = Baseline emissions at year "*y*" during crediting period (tCO_2e)

$BE_{CH4,SWDS,y}$ = Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year "*y*", calculated according to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" (tCO_2e).

According to the above mentioned tool:

$$BE_{CH4,SWDS,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^{y} \sum_{j} \left(W_{j,x} \times DOC_j \times e^{-k_j \times (y-x)} \times \left(1 - e^{-k_j}\right) \right) \quad \text{Equation 5}$$

Where,

$BE_{CH4,SWDS,y}$ = Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)

Φy = Model correction factor to account for model uncertainties for year y

fy = Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y

GWP_{CH4} = Global Warming Potential of methane, valid for the relevant commitment period

OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)

F = Fraction of methane in the SWDS gas (volume fraction)

$DOC_{f,y}$ = Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)

MCF = Methane correction factor

$W_{j,x}$ = Amount of organic waste type j disposed/prevented from disposal in the SWDS in the year x (tonnes)

DOC_j = Fraction of degradable organic carbon in the waste type j (weight fraction)

k_j = Decay rate for the waste type j (1/yr)

j = Type of residual waste or types of waste in the MSW

X = Years in the time period in which waste is disposed at the SWDS extending from the first year in the period (x=1) to year y (x=y)

y = Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)

For $W_{j,x}$, the following equation is used at the time of the project verification:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^{Z_x} p_{n,j,x}}{Z_x} \quad \textbf{Equation 6}$$

Where,

$W_{j,x}$	=	Amount of organic waste type j disposed or prevented from disposal in the SWDS in the year x (t)
W_x	=	Total amount of organic solid waste disposed or prevented from disposal in the SWDS in year x (t)
$p_{n,j,x}$	=	Fraction of the waste type j in the sample n collected during the year x (weight fraction)
Z	=	Number of samples collected during the year x
N	=	Samples collected in year y
J	=	Types of solid waste
X	=	Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)

E.2. Calculation of project emissions or actual net removals

>>

For the Component 1, electricity-generation, AMS-I.D. (V18) determines that "For most renewable energy project activities, PEy = 0" – except geothermal plants and water reservoirs of hydro electricity generation.

In addition, the methodology requires that CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*". This source of emission is considered below while calculating project emissions in the context of AMS-III.E. (Emissions through electricity or diesel consumption in the year "*y*" – $PE_{y,power}$).

For the Component 2 - avoidance of methane generation, project emissions are calculated in accordance with AMS-III.E. (V17), as follows:

$$PE_y = PE_{y,comb} + PE_{TR,m} + PE_{y,power} \quad \textbf{Equation 7}$$

Where,

$PE_{y,comb}$	=	Emissions through combustion and gasification of non-biomass carbon of waste and RDF/SB in the year "*y*"(tCO_2e)
$PE_{TR,m}$	=	Project emissions from transportation of freight in the monitoring period m ($t\ CO_2e$)
$PE_{y,power}$	=	Emissions through electricity or diesel consumption in the year "*y*"(tCO_2e)

In the context of the proposed project activity, project emissions are related to:

- Incremental CO_2 emissions due to transportation of combustion residues and final waste from controlled burning disposal site (paragraph 17bII of AMS-III.E. and tool Project and leakage emissions from transportation of freight version 01.1.0);
- CO_2 emissions related to the fossil fuel consumed by the project activity – *i.e.* back-up diesel generator consumed during downtimes e.g. for maintenance – (paragraph 22c of AMS-III.E.). Electricity consumed from the grid during downtimes is already subtracted in the baseline calculation as only the *net electricity* is accounted for ERs.

The biomass residues used in the proposed project activity do not contain non-biomass carbon and there are no auxiliary fossil fuels used. Hence, the provisions of paragraph 22a of the methodology are not applicable and $PE_{y,comb}$ is zero.

Also incremental CO_2 emissions from incremental distances between the collection points to the project site as compared to the baseline disposal site (paragraph 22bI of AMS-III.E.) is not applicable for MIL, since the biomass residues from the sawmill are directly forwarded to the power plant using conveyor belts which use electricity produced by the plant.

The collection point is the silo within the project boundary. Therefore, project emissions by the project activity consists of the sum of $PE_{y,transp}$ and $PE_{y,power}$ which will be calculated as further detailed below.

Project emissions from transportation of freight

$$PE_{TR,m} = \sum_{f} D_{f,m} * FR_{f,m} * EF_{CO2,f} * 10^{-6}$$

Equation 9

Where,

$D_{f,m}$	=	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m (km)
$FR_{f,m}$	=	Total mass of freight transported in freight transportation activity f in monitoring period m (t)
$EF_{CO2,f}$	=	Default CO_2 emission factor for freight transportation activity f (g CO2/t km)
f	=	Freight transportation activities conducted in the project activity in monitoring period m

Emissions through back-up diesel consumption of the project activity

According to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" the emissions are calculated as follows:

$$PE_{y,power} = PE_{FC,j,y}$$

Equation 10

And:

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

Where:

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

The project uses the 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:

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

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

The most conservative option has been chosen for this monitoring period for the determination of the quantity of electricity generated by the backup diesel generator, what is the amount of diesel consumed for

the diesel generator - For conservativeness, this highest value (5,000.0l) of all available data is applied. For the application of the actual values and the calculation results in this monitoring period, please refer to the Emission Reduction excel spreadsheet.

E.3. Calculation of leakage emissions

>>

In the specific CDM-PDD it is analysed and concluded that there is no leakage due to the project activity.

E.4. Calculation of emission reductions or net anthropogenic removals

Emission reductions of the project activity are calculated as follows:

$$ER_y = (BE_y + BE_{CH4,SWDS,y}) - PE_y - LE_y \qquad \textbf{Equation 8}$$

Where,

$BE_{y,power}$ = Baseline emissions for electricity generated by the plant and supplied to the grid in the year *y* (tCO_2)

$BE_{CH4,SWDS,y}$ = Yearly Methane Generation Potential of the wastes diverted to be disposed in the disposal site from the beginning of the project (x=1) up to the year "*y*", calculated according to the "Tool to determine methane emissions avoided from disposal waste at a solid waste disposal site" (tCO_2e).

PE_y = Project emissions during year *y* (tCO_2)

LE_y = Leakage emissions during year *y* (tCO_2)

In conclusion, the total of the emission reductions achieved during the monitoring period are:

Baseline emissions from component 1, Electricity Generation:	38,057tCO_2e
Baseline emissions from component 2, Methane Avoidance:	2,733tCO_2e
Total baseline emissions:	40,790tCO_2e
Total project emissions:	14tCO_2e
Total leakage:	0 tCO_2e

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)			
				Before 01/01/ 2013	From 01/01/ 2013 until 31/12/ 2020	From 01/01/ 2021	Total amount
Total	40,790	14	0	0	40,776	0	40,776

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
40,776	29,658

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

>>

For component 1, the value used for ex-ante estimation is based on the total net electricity exported to the grid during the last three years of operation of the plant in the 2nd crediting period excluding electricity consumed from the grid by the plant. The ex-ante value used for parameter emission factor used for CO_2 emission factor of the grid electricity is also based on the last three years of operation of the plant in the 2nd crediting period (see detailed calculation in Emission Reduction excel spreadsheet, table BL1 Electricity at the bottom).

For component 2, methane avoidance, the ex-ante value for parameter total amount of organic waste prevented from disposal in a year is based in the average of the monitored amount in the 2nd crediting period (see detailed calculation in Emission Reduction excel spreadsheet, table BL2 Methane).

E.6. Remarks on increase in achieved emission reductions

>>

The difference between estimated and actual values (see E.5 above) accounts in total 11,118 tCO_2e.

This is mainly due to the fact that there was a higher availability of wood waste from the saw mill than estimated[14]. The average wood waste per month in the 2nd crediting period was 8,057.460 tons. The lowest monthly average was 6,301 tons in 2002/03, 21.8% below the average value of the 2nd crediting period. The highest monthly average was 10,105.333 tons in 2005/06, 25.4% above the average value of the 2st crediting period. Thus yearly values can easily differ within a range +-25%.

In the current monitoring period the monthly wood waste average amounted to 7,599.068 tons, 5.7% below the average value of the 2nd crediting period. Thus, this deviation is reasonably within the normal fluctuation of the wood waste ability of the saw mill which depends again on the log availability from the forest which depends again e.g. on weather conditions, tree quality and availability. The uptimes of the machinery in the forest and in the saw mill are other factors that create fluctuations in harvest quantities and saw mill yields. There is also a human factor that influences the availability of wood waste for BK Energia: depending on the time when the harvest permits are obtained from the authority, Precious Woods Amazon may have shorter or longer harvest periods which trigger again the saw mill input.

For component 1, electricity generation, the yearly net electricity generation in the actual monitoring period was 48,979.856 MWh, thus 13,696.856 MWh or 38.82% higher than estimated in the PDD (see detailed calculation in Emission Reduction excel spreadsheet, table BL1 Electricity at the bottom). Due to an improvement of the plant's efficiency. It burns less biomass than before based on a better efficiency (electricity generated by biomass burn) and rational use of internal energy.

For component 2, Methane avoidance, 18 tCO_2e or 0.65% less Emission Reductions than estimated in the PDD are calculated for this Monitoring Period (see detailed calculation in Emission Reduction excel spreadsheet, table BL2 Methane). The reduction of the level of methane avoidance emissions has been occurred because the inclusion of the parameter BMP_j. As less wood waste has been use in the actual monitoring period and the decrease of the wood waste in previous years (compared to the estimated in the PDD) lead to less Methane Emissions as an overall than the estimated in the PDD.

E.7. Remarks on scale of small-scale project activity

>>

Component 1, electricity-generation

Component 2, methane-emissions-avoidance

Both project components are eligible under the simplified procedures for small-scale CDM project activities.

[14] Biomass data 2020 from Saw Mill has been provided to DOE for Verification.

For component 1, the power plant has 9 MW of nominal installed capacity, below the eligibility limit for type I: Renewable energy project activities with a maximum output capacity of 15 MW.

For component 2, the emissions directly related to the activity related to project activity, i.e., from the consumption of diesel for generating electricity when the power plant is down (PEy,power) are of around 180 tCO2e annually (below the eligibility limit of 15,000 tCO2e annually). The calculation of the emissions directly related to the project is detailed in section E.2.

- - - - -

Document information

Version	*Date*	*Description*
08.0	6 April 2021	Revision to: • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

Version	*Date*	*Description*
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report