PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	San Carlos 18 MW Biopower Power Plant
Version number of the PDD	Version 5
Completion date of the PDD	28/12/2012
Project participant(s)	San Carlos Biopower Inc.
Host Party(ies)	Philippines
Sectoral scope and selected methodology(ies)	Sectoral scope 1 – Energy industries (renewable/non-renewable sources) ACM0018, version 02.0.0 – Consolidated methodology for electricity generation from biomass residues in power-only plants
Estimated amount of annual average GHG emission reductions	64,088 tons CO_2e

Description of project activity

A.1. Purpose and general description of project activity

The project activity is the installation and operation of a greenfield 18 MW[1] biomass power plant in San Carlos City, Negros Occidental, Philippines, to generate renewable energy for grid connection using biomass resources within a 40-km radius. It shall primarily utilize cane field residues commonly left on the ground either to decay or be burnt, and grassy and woody biomass from dedicated energy crop plantations to be established in the hills of San Carlos and neighbouring municipalities. During the initial years of operation, while the plantations are being established, woody biomass would be sourced from existing private tree plantations for use along with other agriculture residues. The project will supply base load power from renewable energy to the Luzon-Visayas Grid (2.5 km transmission line to the Connection Point of the Grid).

The technology will be the combustion of biomass to produce steam in a boiler. The steam will be used to run a turbine to produce electricity.

The source of baseline emissions to be reduced is from the grid electricity generation that would be supplied by this CDM project activity, which would have been supplied by the Luzon-Visayas grid without this CDM project. The project will result to greenhouse gas emission reduction of an annual average **64,088** tons CO_2 and a total of **448,614** tons CO_2 for the 7 years crediting period.

Existing Scenario

The project is a 'greenfield' project. There is no existing power plant operating at the project site prior to this CDM project.

The volume of cane trash left in the field after cane harvest is simply enormous that open field burning has become a common practice[2] despite the Clean Air Act[3] prohibition. Open burning[4] is practiced as it is the most cost-efficient method of eliminating voluminous cane trash to prevent rat infestation and allow successful ratoon (regrowth of stubles) or prepare the land for new cropping cycle. This information is publicly available at the Sugar Regulatory Administration[5] of the Department of Agriculture.

[1] EPC Contractor's Tender

[2] TC Mendoza, R Samson. *Relative Bioenergy Potentials of Major Agricultural Crop Residues in the Philippines*. Philippine Journal of Crop Science, 31(1): 11-28. April 2006

[3] http://www.congress.gov.ph/download/ra_11/RA08749.pdf

[4] http://www.philsurin.org.ph/

[5] http://www.sra.gov.ph/menu_statistics.html

<u>Contributions to sustainable development</u>

This CDM project will contribute to the country's sustainable development goals, particularly in reducing dependence on fossil fuel for power generation and creation of sustainable livelihood and countryside development; and to reduce greenhouse gas emissions in power generation using renewable fuel (biomass for this project).

<u>Environmental benefits</u>

- Reduce GHG emission by displacing fossil fuel usage in power generation
- Utilization of carbon neutral, renewable fuel
- Encourage utilization of idle lands through establishment of Energy Farms
- Reduce open-burning of sugarcane field residues thereby improving ambient air quality in the farms and nearby communities – supports the Clean Air Act of the Philippines

<u>Social benefits</u>

- New baseload power for the Luzon-Visayas grid translates to better electricity services of Utility Distributors thus improving living condition particularly in the host Local Government Unit (LGU);
- Employment generation at the plant station and increase employment and income in farm-related/ biomass sourcing
- Social benefits for the employees and workers
- Additional income contribution to the Local Government Unit

<u>Economic benefits</u>

- Upland economic development through energy crop establishment on idle lands (making idle lands productive), and provide cash flow for farmers or land owners
- Additional income for lowland farmers by providing value to the cane field residues currently burnt in the fields
- Return of biomass ash from the plant to farmers for their use as fertilizer in their farms. Reduced consumption of inorganic fertilizer application by sugarcane farmers
- Spur downstream industries beginning from plant construction to its operation (e.g. housing, laundry services, entertainment and restaurants)
- Foreign exchange savings

A.2. Location of project activity
A.2.1. Host Party(ies)

Philippines

A.2.2. Region/State/Province etc.

Negros Occidental

A.2.3. City/Town/Community etc.

Barangay Palampas, San Carlos Ecozone, San Carlos City

A.2.4. Physical/Geographical location

The center of the biomass power plant has the geographic coordinates: 123°25'16"E and 10°30'36"N. Figure 1 illustrates the location.

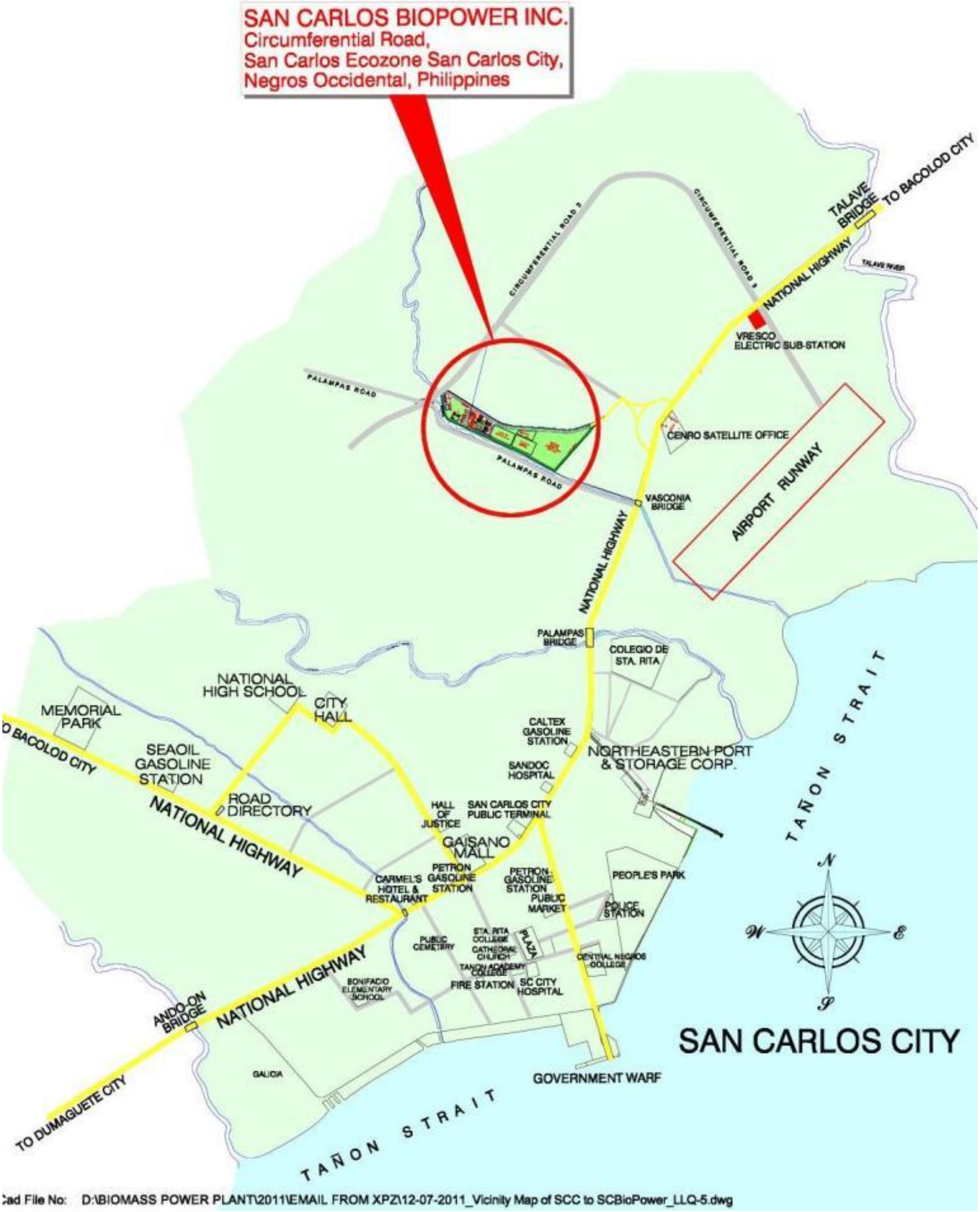

Figure 1. Location Map of San Carlos Biopower Inc.

A.3. Technologies and/or measures

The CDM Project:
The technology will be the combustion of biomass for the production of steam in a boiler to feed to a turbine for electricity generation. As shown in the next figure, the power plant will consist of an advanced biomass-fired high-pressure boiler, steam turbine and generator with ancillary equipment.

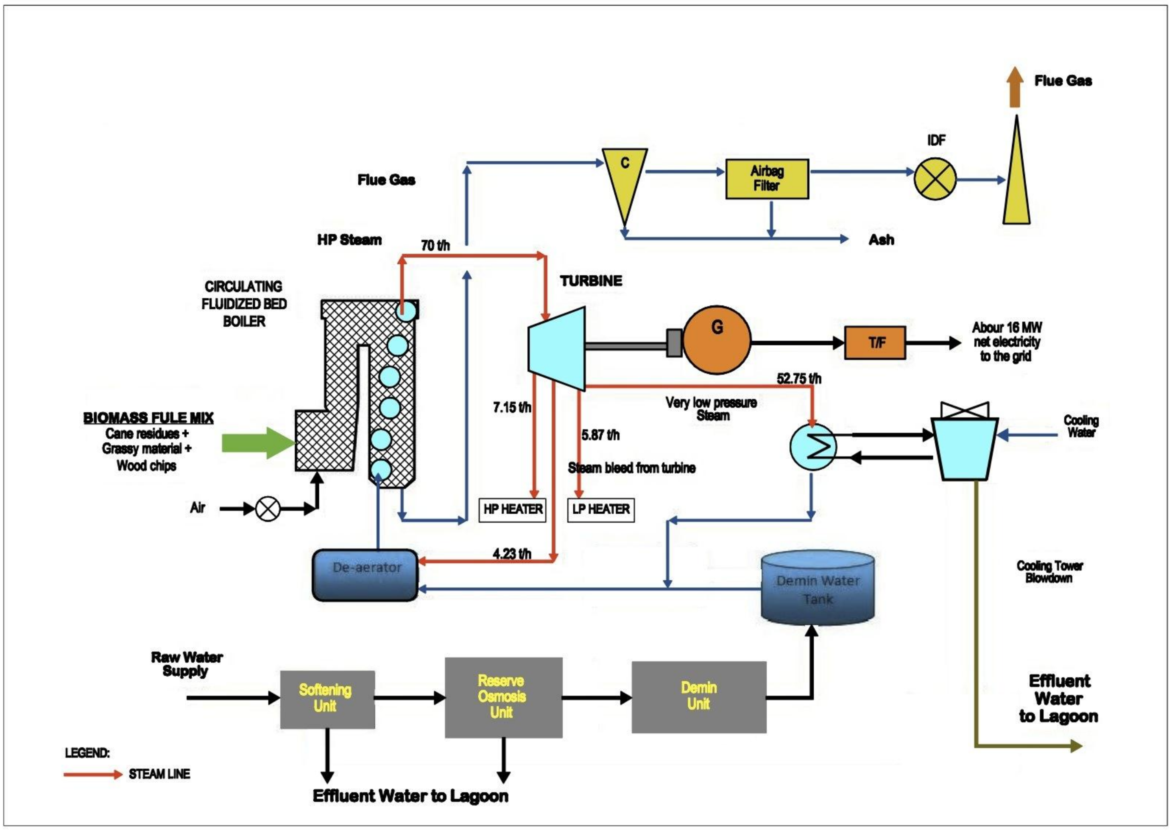

Figure 2. San Carlos Bio Power Projected Process Flow

The circulating fluidized bed technology was selected primarily due to its flexibility in utilizing various types of biomass fuels considering variable moisture, high-alkali and high chlorine nature of the fuel. The boiler will consist of the boiler proper, a forced air-fan draft system, an induced draft fan, air pre-heater, and steam, air and flue gas ducts. The operating conditions of the boiler are 70 to 75 tons of steam per hour at 98 bar (abs) and 540°C. The boiler will supply the steam requirements for the 18 MW condensing-steam turbine-generator set. The generator produces 3-phase electrical power at 18 MW gross power, some of which (approximately 2 MW) is required to energize all the electrical motors that drive the conveyors, fans, pump motors, dust collector, control system, etc. of the power-plant. The net power output of the plant is approximately 16 MW and stepped-up to 69 kV and phase-synchronized before being evacuated via an approximately 2 km transmission line and connected to the grid. Calibrated meters will be installed to measure gross power located at the generator, net power for export, and auxiliary or plant load. All power meters will be located inside the plant. The primary fuel will be agricultural residues, particularly cane field residues commonly known as cane trash, and others such as, but not limited to, coconut husks/shells, rice straw, tree plantation thinnings. Woody and grassy biomass are supplemental fuel that will be harvested from dedicated energy crop plantations which are to be

established for this project. This Project assumes a 25-year[6] plant operating life based on equipment lifetime. The plant will be designed to follow ASME standards for steam power plants using circulating fluidized bed boilers. The plant is expected to be available for 7,884 hours per year (8,760 hours per year at 90% plant availability[7]) with guaranteed boiler efficiency of 92%[8]. The plant, which has a gross capacity of 18MW and 10.5% auxiliary load, is expected to generate 127,011.24 MWh/year.

Based from feed rate, the net capacity may be calculated as follow:

Parameters	Value	Unit	Source
Feed rate	17,229	kg/hr	Contractor's tender
Net calorific value	9,730	kJ/kg	Contractor's confirmatory letter
Conversion factor	3,600	kJ/kWh	1 kWh = 3,600 kJ
Boiler efficiency	92.00%	%	Contractor's tender
Turbine-Generator efficiency	37.50%	%	Contractor's tender

$$Net\ capacity = \left(flow\ rate_{biomass}, in \frac{kg}{hr}\right)\left(NCV_{biomas}, in \frac{kJ}{kg}\right)\left(\frac{1\ kWh}{3{,}600\ kJ}\right)(\eta_{boiler})(\eta_{turbine-generator})\left(\frac{1MW}{1{,}000kW}\right) + administration\ use, in\ MW$$

$$Net\ capacity = \left(17{,}229 \frac{kg}{hr}\right)\left(9{,}730\ \frac{kJ}{kg}\right)\left(\frac{1\ kWh}{3{,}600\ kJ}\right)(0.92)(0.375)\left(\frac{1MW}{1{,}000kW}\right) + (18MW)(0.0025) = 16.11MW$$

The project is a greenfield project. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The following are the equipment specifications[9]:

BOILER	
Manufacturer	Wuxi Huaguang Boiler Electric Inc.
Model	UG-70/9.8/540
Type	Circulating Fluidized Bed
Rated Evaporation Capacity	70 t/hr
Rated Steam Pressure	9.8 MPa
Rated Steam Temperature	540°C ± 5°C
Feed Water Temperature	220°C
Exhaust Temperature	150°C
Efficiency	92%
Quantity	1
STEAM TURBINE	
Manufacturer	HTC
Model	HNK 40/56
Type	High temperature, high pressure condensing steam turbine
Rated Power	18 MW
Rated Steam Inlet Quantity	70 t/hr
Rated Steam Inlet Pressure	8.83 MPa
Rated Steam Inlet Temperature	535°C +5°C -10°C
Feedwater Temperature	220°C
Quantity	1

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf
[7] EPC Contractor's Tender
[8] EPC Contractor's Tender
[9] EPC Contractor's Tender

GENERATOR	
Manufacturer	Shangdong Jinan
Model	60 WX14L – 040 LLT
Rated Power	18
Rated Voltage	13.8 kV
Rated Power Factor	0.85
Frequency	60 Hz
Quantity	1
Combined Turbine-generator efficiency	37.5%

Steam Balance[10]	Flow Rate (tons/hr)	Temperature (^oC)	Pressure (MPa)
Steam turbine – steam inlet	70	535	8.83
Steam turbine – 1st stage extraction steam	7.15	381.5	2.54
Steam turbine – 2nd stage extraction steam	4.23	253.2	0.812
Steam turbine – 3rd stage extraction steam	5.87	214.3	0.21
Steam turbine – steam outlet	52.75	0.01	45.8

Fuel Processing and Handling[11]

Fuel will be delivered to the facility on trucks ranging in capacity from 10 to 30 tons. A weigh scale and moisture analyzer will be installed at the plant site to measure the weight and moisture content of the various biomass fuel types as they are delivered. The facility will include covered and open storage for various fuel types, while processing will be done under cover. The fuel will be processed to a size specified by the boiler manufacturer, and the conveying and feeding system will be designed to provide fuel for 24-hour continuous operation of the Plant. The fuel consumption will be approximately 20 tons per hour ("tph") at the maximum continuous rating ("MCR") of the Plant. Two feeding conveyors to the boiler will each have belt weighers that will be connected directly to DCS with a totalizer.

Water Supply System

The facility is expected to require about 140 cubic meters (m^3) per hour of water. Water will be supplied on a 20 year contract by the San Carlos Economic Zone's designated water supplier which owns and operates the deep-well aquifer located under one kilometer away from the facility and with a production capacity of approximately $300m^3$ per hour. Raw water from the deep-well will be clarified, filtered, and de-aerated prior to use in the boiler.

Waste Treatment Facilities

The wastewater of the Plant can be categorized into industrial wastewater, sewerage from the office buildings and rainwater. Most of the industrial wastewater produced will be in the form of boiler blow-down, cooling water blow-down, and some from the water treatment. Oily waste from the transformer and turbine areas will be collected, skimmed, separated and disposed of in an acceptable way. The cleaned water will be used to supply service water to the Plant and the site. The excess cleaned wastewater from the facility will be discharged in conformity with the local environmental standards. The office sewerage will be pumped into an underground latrine and the rainwater will be drained away via a separate storm-water system.

[10] Detailed process flow diagram per EPC Contractor's Tender

[11] a) *Integrated Cane & Residue Collection Feasibility Report*, Bronzeoak Group, GENESYS Foundation, Booker Tate, Conducted in cooperation with Renewable Energy & Energy Efficiency Partnership (March 2005), b) *Cane Residue Collection Trials & Transport Study: Final Report*, Bronzeoak Phils (RRodriguez), Talisay Bioenergy Inc., EC-ASEAN Fund, Global Opportunities Fund (March 2004)

The plant is expected to generate ash volume of about 40 to 60 tons per day depending on type of biomass.

Transmission Line

A net output of approximately 16 MW will be available for sale to the electricity grid system net of the facility's parasitic load. The electricity sold by the facility will be interconnected to the 69 kV national electric grid at an electrical substation located approximately 2 km from the facility.

Supply of biomass fuel[12]

The plant requires about 184,140[13] tons of biomass comprising sugar cane residue (leafy residues left on the ground post harvest), energy crop plantations (ECP), current tree stands, and other biomass. The ECP will be composed of grassy ECP and woody ECP. The entire biomass requirement of the plant can be sourced from the annually existing sugar cane residues and represents only 10% of the available resource within the 40-km radius. However as a strategy, as cane trash is not a commodity in the area and there is no existing supply chain system, the project will build up its capability to manage the supply chain up to 60% of the fuel mix. The rest of the fuel will be other types of biomass which is composed of components of the coconut tree (fronds, husks and shells), rice (straw and husks), corn (stalks and cobs) as well as bamboo. A local type of bamboo can be grown as a 'dedicated plantation' for the CDM project.
The current tree stands (CTS) from private tree plantation will supply the biomass fuel while the ECPs are being established over the initial years of operation of the facility. These sources will be limited to purpose-grown plantations' thinnings or harvest wastes and will not include primary or secondary natural growth forests. Such plantations abound throughout the island and are mostly of introduced plantations species.

In order to ensure its capacity to sustainably source the annual fuel requirement, SCBP will establish a Fuel Supply Division separate from the power plant operating organization. While the power plant's manpower will be focused on operating and maintaining the plant, the Fuel Supply Division's objective is to source, produce and supply the facility's annual feedstock requirement. Although most power plant organizations would have a team of personnel limited to outsourcing its raw material requirement from the market or third party suppliers, this project's approach is to develop the internal capability to engage in all aspects and activities that may be required to produce, collect and transport the fuel. This is a strategic decision to mitigate the risk of the lack of reliable sources, undeveloped local market, and logistics infrastructure for biomass supply.

The Fuel Supply Division will primarily engage in two operations:

- Logistics – to own, maintain and operate a fleet of equipment and personnel to gather, collect, receive, process, store and transport fuel from various sources to the plant site.
- Energy Crop Plantations – to establish, maintain and operate plantations as dedicated and sustainable sources of biomass fuel for the power plant.

A Division Manager of the Fuel Supply Division will lead the organization and report directly to SCBP's Chief Operations Officer (COO). Supporting the Division Manager will be a Logistics Department Manager, an Energy Crop Plantation (ECP) Department Manager and an Administrative Manager. The project's strategy is to provide the Division with all the necessary resources that may be required to source and supply the fuel, including a fleet of trucks, farm collection equipment and as many as 150 personnel.

[12] a) *Fuel Supply Study*, Biomass Resources Inc (June 2012), b) *Biomass Assessment Study*, Biomass Resources Inc (June 2010), c) *Philippine Biofuel Resources*, Chris Norris (May 2003)

[13] Average of 7 years field quantity

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Philippines	San Carlos Biopower Inc. (Private entity)	No

A.5. Public funding of project activity

No public funding will be used for this project.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

ACM0018, version 02.0.0 – Consolidated methodology for electricity generation from biomass residues in power-only plants

Tool to calculate the emission factor for an electricity system, version 03.0.0

Project and leakage emissions from road transportation of freight, version 01.0.0

Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, version 02

Guidelines on the assessment of investment analysis, EB 62 Annex 5, version 05

B.2. Applicability of methodology

The Project meets the requirement for a Large-scale CDM project (18 MW is more than 15 MW) and all the applicability conditions of ACM0018 version 02.0.0 and justified below:

ACM0018 version 02.0.0 – Applicability Criteria	This CDM Project:	Does the Project Qualify?
This methodology is applicable to project activities that generate electricity in biomass residue (co-) fired power-only plants. The project activity may include the following activities or, where applicable, combinations of these activities: • The installation of	The project is the installation of a new biomass residues-fired power-only plant at a site where currently no power generation occurs (greenfield power project);	Yes, under the first category listed which is *"The installation of new biomass residues (co-)fired power-only plants at a site where currently no power generation occurs (greenfield power projects)"*.

new biomass residues (co-)fired power-only plants at a site where currently no power generation occurs (greenfield power projects); • The installation of new biomass residues (co-)fired power-only plants, which replace or are operated next to existing power-only plants fired with fossil fuels and/or biomass residues (power capacity expansion projects); • The improvement of energy efficiency of existing biomass residues (co-)fired power-only plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant; • The total or partial replacement of fossil fuels by biomass residues in an existing power-only plant or in a new power-only plant that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass residues use as compared to the baseline, by retrofitting an existing plant to use biomass residues, etc.		
The biomass residues used in the project activity may be produced on-site (e.g. if the project activity is based on the operation of a power plant located in an (agro-	The biomass residues used in the project activity are obtained off-site. The biomass will be sourced from existing sugarcane fields, dedicated energy crops and agricultural residues within 40-km radius.	Yes

<table>
<tr>
<td>) industrial plant generating the biomass residues), or they can be obtained off-site from the nearby area, specific suppliers or purchased from a market.</td>
<td>
<table>
<tr><th>Supplier[14]</th><th>Distance of farm from the Plant (km)[15]</th></tr>
<tr><td>Biomass Resources Inc</td><td>Between 1-40*</td></tr>
<tr><td>Negocor</td><td>Between 1-40**</td></tr>
<tr><td>Nelson Lim</td><td>10</td></tr>
<tr><td>Belmayor Devt Corp</td><td>13</td></tr>
<tr><td>Jun Ballesteros</td><td>30</td></tr>
<tr><td>GHI MPC</td><td></td></tr>
<tr><td>Hacienda Euzkara</td><td>6</td></tr>
<tr><td>High Grains (Quezon)</td><td>40</td></tr>
<tr><td>Hacienda Providencia</td><td>2</td></tr>
<tr><td>Brgy Punao</td><td>5</td></tr>
<tr><td>Hacienda San Vicente</td><td>3</td></tr>
<tr><td>Hacienda Socorro</td><td>3</td></tr>
<tr><td>Hacienda Vasconia</td><td>1</td></tr>
<tr><td>Hacienda Filomena</td><td>3</td></tr>
<tr><td>Hacienda Tranquilino</td><td>8</td></tr>
<tr><td>GENESYS Foundation</td><td>Between 1-40***</td></tr>
<tr><td>Manuel Puertillano</td><td>7</td></tr>
<tr><td>Anecito Amoy</td><td>11</td></tr>
<tr><td>Marciana Baculi</td><td>38</td></tr>
<tr><td>Benigno Palmares</td><td>40</td></tr>
<tr><td>Angelito Donan</td><td>40</td></tr>
<tr><td>Reynaldo Dagoldogol</td><td>40</td></tr>
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<td></td>
</tr>
<tr>
<td>The methodology is applicable under the following conditions:
(1) No other biomass types than biomass residues, as defined above, are used in the project plant;</td>
<td>(1) All biomass that will be used are within the definition of biomass residues.</td>
<td>Yes</td>
</tr>
<tr>
<td>(2) Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired shall not exceed 80% of the total fuel</td>
<td>The amended Environmental Compliance Certificate[16](ECC) issued to San Carlos Biopower Inc. by the Department of Environment and Natural Resources (DENR), the project is allowed to utilize lignite up to 25% of the fuel mix. This translates to approximately 25% fossil fuel consumption on an</td>
<td>Yes</td>
</tr>
</table>

[14] Fuel Supply Agreements
[15] Biomass Assessment Study by Biomass Resources Inc.
[16] Per ECC No. ECC-R6-0912-393-4220

<table>
<tr><td>fired on an energy basis;</td><td>energy basis, using the net calorific values (NCV) of lignite 9.99 GJ/ton. If lignite will constitute 25% of the fuel mix by mass, this translates to 25.50% of the total heat requirement. Therefore, the possible co-firing of lignite will not exceed the 80% of the total fuel fired on an energy basis.

<table>
<tr><th>CASE 1: Energy basis</th><th>Lignite</th><th>Biomass</th></tr>
<tr><td>Total heat requirement (GJ/yr)</td><td colspan="2">1,561,032</td></tr>
<tr><td>Proportion, energy basis (%)</td><td>25%</td><td>75%</td></tr>
<tr><td>Heat produced (GJ)</td><td>390,258</td><td>1,170,774</td></tr>
<tr><td>NCV (GJ/ton)</td><td>9.99</td><td>9.73</td></tr>
<tr><td>Tonnage (tons)</td><td>39,065</td><td>120,326</td></tr>
<tr><td>Corresponding mass percentage (%)</td><td>24.51%</td><td>75.49%</td></tr>
</table>

<table>
<tr><th>CASE 2: Mass basis</th><th>Lignite</th><th>Biomass</th></tr>
<tr><td>Mass percentage (%)</td><td>25%</td><td>75%</td></tr>
<tr><td>Tonnage (tons)</td><td>26,739</td><td>80,217</td></tr>
<tr><td>Heat produced (GJ)</td><td>267,123</td><td>780,511</td></tr>
<tr><td>Corresponding heat percentage (%)</td><td>25.50%</td><td>74.50%</td></tr>
</table>
</td><td></td></tr>
<tr><td>(3) For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;</td><td>The project does not use biomass residues from a production process (e.g. production of sugar or wood panel boards). Hence, the conditions for projects that use biomass residues from a production process do not apply.</td><td>Yes. This criterion is not applicable to the project.</td></tr>
<tr><td>(4) The biomass residues used by the project facility should not be stored for more than one year;</td><td>Storage will be implemented on a “first in, first out (FIFO)” basis, where the older bales will be taken out first under strict schedule to ensure that no biomass residues will be stored for more than one year.</td><td>Yes</td></tr>
<tr><td>(5) Projects that chemically process the biomass residues prior to combustion (e.g. by means of esterification,</td><td>The biomass residues will not be processed chemically prior to combustion.</td><td>Yes</td></tr>
</table>

fermentation and gasification) are not eligible under this methodology. The biomass residues can however be processed physically such as by means of drying, pelletization, shredding and briquetting;		
(6) No power and heat plant operates at the project site during the crediting period;	No power and heat plant will operate at the project site during the crediting period.	Yes
(7) If any heat is generated for purposes other than power generation (e.g. heat which is produced in boilers or extracted from the header to feed thermal loads in the process) during the crediting period or was generated prior to the implementation of the project activity, by any on-site or off-site heat generation equipment connected to the project site, the following conditions should apply: (a) The implementation of the project activity does not influence directly or indirectly the operation of the heat generation equipment, i.e. the heat generation equipment would operate in the same manner in the absence of the project activity; (b) The heat generation equipment does not influence directly or indirectly the operation of the project plant (e.g. no fuels are diverted	No heat is generated for purposes other than power generation. Hence, the conditions for project activities where heat is generated for purposes other than power generation do not apply.	Yes. This criterion is not applicable to the project.

from the heat generation equipment to the project plant); and (c) The amount of fuel used in the heat generation equipment can be monitored and clearly differentiated from any fuel used in the project activity.		
(8) In the case of fuel switch project activities, the use of biomass residues or the increase in the use of biomass residues as compared to the baseline scenario is technically not possible at the project site without a capital investment in: • The retrofit or replacement of existing heat generators/boilers; or • The installation of new heat generators/boilers; or • A new dedicated biomass residues supply chain established for the purpose of the project (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); • Equipment for preparation and feeding of biomass residues.	The project activity does not involve fuel switching. Hence, the conditions for fuel switch activities do not apply.	Yes. This criterion is not applicable to the project.
Finally, the methodology is only applicable if the most plausible baseline scenario, as identified per the 'Procedure for the selection of the baseline scenario and demonstration of additionality' section	The most plausible scenarios are: P5 for power generation and B3for biomass use.	Yes

hereunder, is: • For power generation: Scenarios P2 to P7, or a combination of any of those scenarios; • For biomass use: Scenarios B1 to B8, or a combination of any of those scenarios. However, note that for scenarios B5 to B8, leakage emissions should be accounted for as per the procedures of the methodology.		

B.3. Project boundary

	Source	GHGs	Included?	Justification / Explanation
Baseline	Electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Included	Project participants may decide to include this emission source, where case B1, B2 or B3 has been identified as the most likely baseline scenario
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources
Project Activity	On-site fossil fuel consumption	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	On-site and off-site transportation and processing of biomass residues	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass residues for electricity	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Included	This emission source must be included if CH_4 emissions from uncontrolled burning or decay of biomass residues in the baseline scenario are included
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small
	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be very small
	Wastewater from the treatment of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	This emission source shall be included in cases where the waste water is treated (partly) under anaerobic conditions
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small

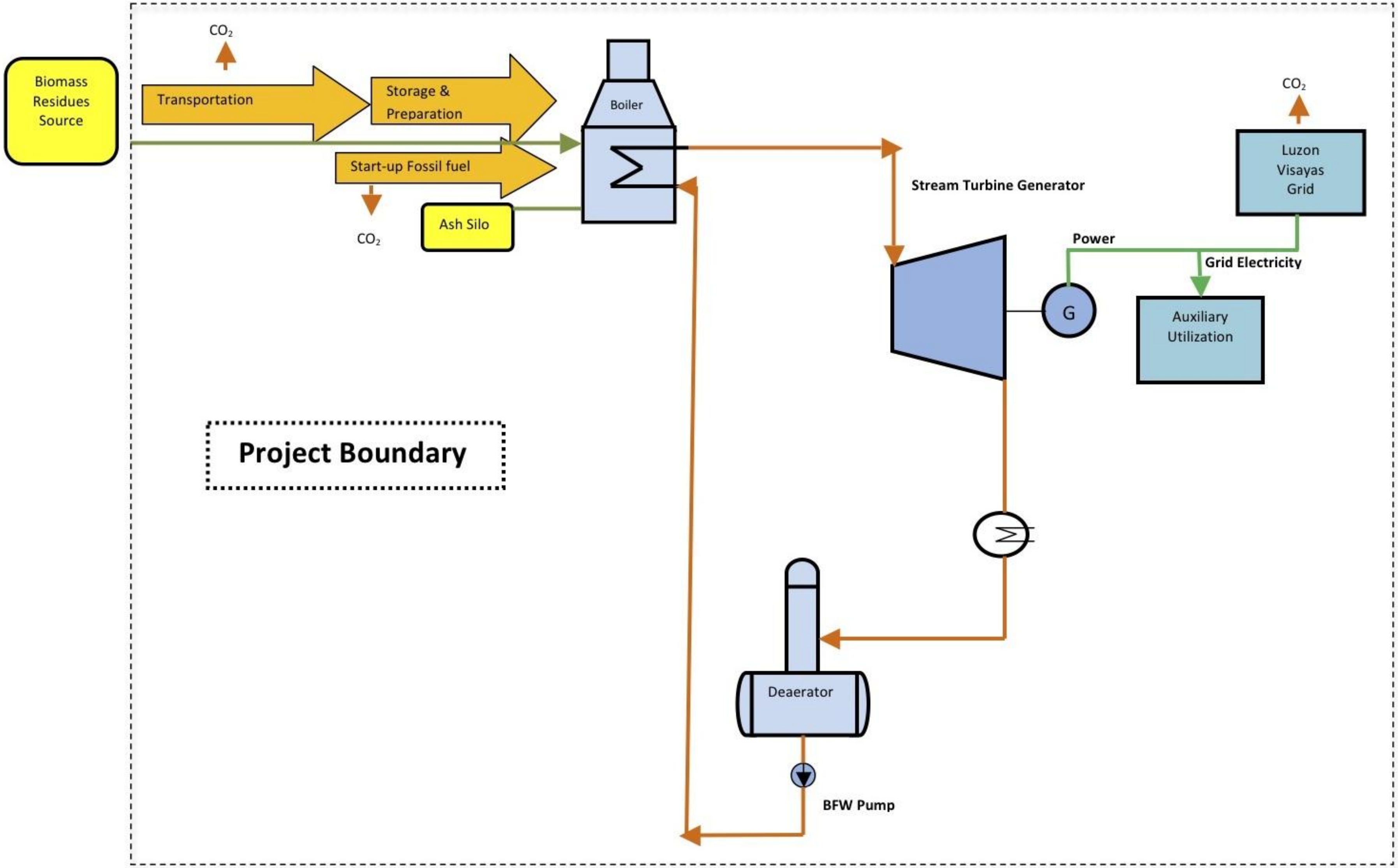

Figure 3. Schematic Diagram of Project Boundary

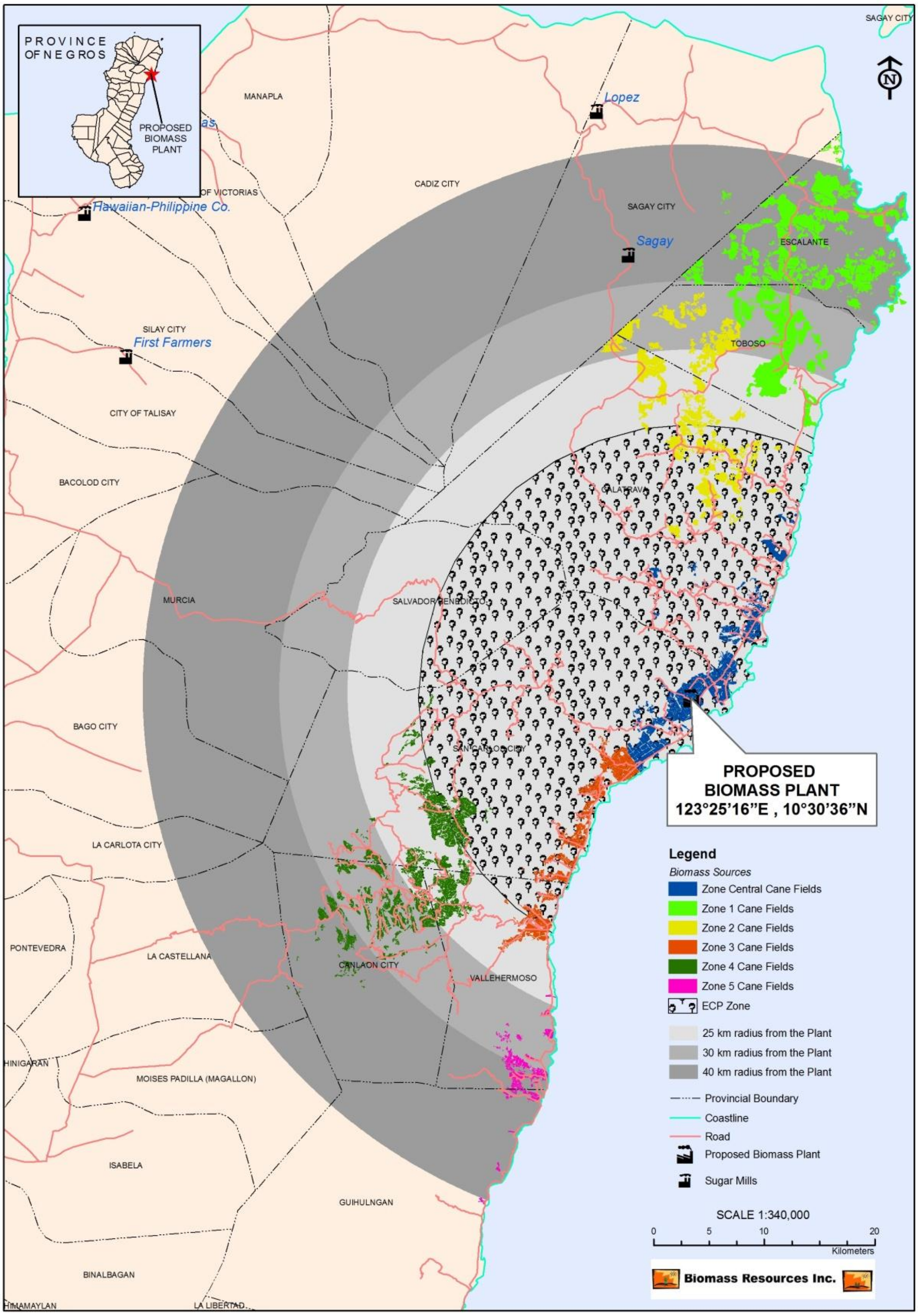

Figure 4. Map indicating distribution of biomass residues and potential ECP zone.

B.4. Establishment and description of baseline scenario

Procedure for the selection of the baseline scenario and demonstration of additionality

The selection of the baseline scenario and demonstration of additionality should be conducted by applying the following steps:

Step 1: Identification of alternative scenarios

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

Step 1a: Define alternative scenarios to the proposed CDM project activity

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

In doing so, alternative scenarios should be separately determined regarding:

- How electric power would be generated in the absence of the CDM project activity; and
- What would happen to the biomass residues in the absence of the project activity.

The alternative scenarios for electric power should include, *inter alia*:

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

P2: If applicable,[17] the continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The existing power-only plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the project activity;

P3: If applicable,[1] the continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The existing power-only plants would operate with different conditions from those observed in the most recent three years prior to the project activity;

P4: If applicable,[1] the retrofitting of existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The retrofitting may or may not include a change in fuel mix;

P5: The generation of power in the grid;

P6: The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using the same amount or less biomass residues than under scenario P1:;

P7: The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using more biomass residues than under scenario P1:

For the use of biomass residues, the alternative scenarios for biomass residues should include, *inter alia*:

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

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

B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled[18] or left to decay on fields;

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

B4: The biomass residues are used for electricity generation in power-only plant configuration at the project site in new and/or existing power plants;

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

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

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

B8: The primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.[19]

Outcome of Step 1a: List of plausible alternative scenarios to the project activity

Alternative scenarios **B3, P1, and P5 apply**, as will be shown in the succeeding paragraphs.

Since the project is a Greenfield project, only scenarios P1 and P5 apply for electric power, as per the methodology:

> ***(ACM0018, Version 2.0.0, page 9):*** *"If the project activity is the establishment of a greenfield power plant and supplies electricity only to the grid, then the alternatives considered for power generation* ***should include only the scenarios P1 and P5****. In this case, it can be considered that the electricity delivered by the project activity would have otherwise been generated by the operation of existing or new grid-connected power plants, established either by the project participants or by third parties."*

Alternative Scenarios for electric power	Are the Alternative Scenarios realistic and credible?
P1: The proposed project activity not undertaken as a CDM project activity;	**YES** This alternative is a plausible scenario, which will be further analyzed. For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***
P2: If applicable (this alternative is only applicable if there are existing power plants operating at the project site), the continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a	**NO.** The project is a 'greenfield' project. There is no existing power plant operating at the project site prior to this CDM project. For greenfield projects, only P1 and P5 are

[18] Further work is undertaken to investigate to which extent and in which cases methane emissions may occur from stock-piling biomass residues. Subject to further insights on this issue, the methodology may be revised.

[19] For example, this scenario can be used if biomass residues are purchased from a market, or biomass residues retailers, or if processed biomass is purchased from biomass processing plants which are not included in the project boundary.

combination of both, at the project site. The existing power-only plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the project activity;	considered, per ***ACM0018, Version 2.0.0, page 9.***
P3: If applicable (this alternative is only applicable if there are existing power plants operating at the project site), the continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The existing power-only plants would operate with different conditions from those observed in the most recent three years prior to the project activity;	**NO.** The project is a 'greenfield' project. There is no existing "power-only" plant operating at the project site prior to this CDM project. For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***
P4: If applicable (this alternative is only applicable if there are existing power plants operating at the project site) the retrofitting of existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The retrofitting may or may not include a change in fuel mix;	**NO.** The project is a 'greenfield' project. There is no existing "power-only" plants fired with biomass residues or fossil fuels operating at the project site prior to this CDM project. For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***
P5: The generation of power in the grid;	**YES.** Without the project, the grid will continue to supply a more-GHG-intensive output. For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***
P6: The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using the same amount or less biomass residues than under scenario P1.	**NO.** For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***
P7: The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using more biomass residues than under scenario P1:.	**NO.** For greenfield projects, only P1 and P5 are considered, per ***ACM0018, Version 2.0.0, page 9.***

Alternative Scenarios for the use of biomass residues		Are the Alternative Scenarios realistic and credible?
B1: The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields;	There is abundant cane field residues/cane trash in the whole of Negros Island. However, due to the long period of cane trash on-site decomposition, cane trash are often burned.	**No.**
B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;	Not applicable	**No.**
B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes;	As mentioned above for B1, it is common practice in the area that cane trash are burned within 3 to 5 days after harvest to reduce its volume and prevent rat infestation in the ratooning sugarcane fields.	**Yes. This is the most plausible baseline scenario.** .
B4: The biomass residues are used for electricity generation in power-only plant configuration at the project site in new and/or existing power plants;	There is neither existing nor proposed new power plant at the project site other than this project activity. This is not an alternative scenario for this project. The Methodology also does not specify that this is the project activity without CDM.	**No.**
B5: The biomass residues are used for power and/or heat generation in other existing or new power plants at other sites;	Sugar mill boilers are fuelled by bagasse, which is a by-product in sugarcane milling. This project activity, however, will not utilize bagasse. Moreover, bagasse-boilers cannot use cane trash as fuel, since their high-alkali[20]	**No.**

[20] Werther, J., et al. "Combustion of agricultural residues." *Progress in energy and combustion science* 26.1 (2000): 1-27. Available on Elsevier.

	content will cause slagging[21] in the boiler.	
B6: The biomass residues are used for other energy purposes, such as the generation of bio-fuels;	There are no existing bioenergy facilities in the Island that utilizes the biomass residue as fuel or as feedstock for bio-fuel (bioethanol) production.	**No.**
B7: The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry);	Some farmers are employing Trash Farming by utilizing the cane field residues. However, this is not a common practice. Due to the excessive volumes available on the field, farmers still reduce the volume on the field by open burning before practicing Trash Farming (on-site decomposition) as fertilizer.	**No.**
B8: The primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.	The cane trash to be used, in the absence of the project, is burned in an uncontrolled way at the fields.	**No.**

Since different types or sources of biomass residues are used in the project activity, the most plausible baseline scenario for the use of biomass residues is determined for each type and source of biomass separately. The respective biomass residue types, quantities and sources are documented transparently in this CDM-PDD.

Table 1. Biomass residue categories.

Biomass Residue category *(k)*	**Type**	**Source**	**Fate in the Absence of the Project Activity**	**Use in Project Scenario**	**Delivered Quantity (tonnes)**
1	Cane trash	Off-site	Burned	Used as fuel for electricity generation	84,439 (year 1)
2	CTS Thinnings/ harvest wastes	Off-site	Burned	Used as fuel for electricity generation	82,763 (year 1)
3	Other agricultural residues (coconut husks and shells, corn cobs, rice straw)	Off-site	Burned	Used as fuel for electricity generation	9,613 (year 1)

[21] Jenkins, B. M., L. L. Baxter, and T. R. Miles. "Combustion properties of biomass." *Fuel Processing Technology* 54.1 (1998): 17-46. Available at http://www.et.byu.edu/~tom/classes/733/ReadingMaterial/Jenkins-Baxter.pdf

4	Woody ECP	Offsite	-	Used as fuel for electricity generation	0 (year 1)
5	Grassy ECP	Offsite	-	Used as fuel for electricity generation	6,061 (year 1)

The methodology further provides:

> ***(ACM0018, Version 2.0.0, page 11):*** *"For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario. Towards this end, for each biomass residues category, one of the following procedures should be applied:*
>
> *(a) Demonstrate that there is an abundant surplus of the type of biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of that type of biomass residues available in the region is at least 25% larger than the quantity of biomass residues of that type which is utilized in the region (e.g. for energy generation or as feedstock), including the project plant;*
>
> *(b) Demonstrate for the sites from where biomass residues are sourced that the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled or burnt without energy generation (e.g. field burning) prior to their use under the project activity. This approach is only applicable to biomass residues categories for which project participants can clearly identify the site from where the biomass residues are sourced.*
>
> *The scenarios B1:, B2: or B3: can only be regarded as a plausible baseline scenario for a certain category of biomass residues, if the project participants can demonstrate that at least one of the two approaches (a) or (b) are fulfilled. Otherwise, the baseline scenario for this particular biomass residues category should be considered as B8:, and a leakage penalty will be applied when calculating leakage emissions."*

Approach (a), as defined above, applies as will be shown in the following:

The biomass residue (cane trash) production from sugarcane fields in Negros Island is about Six Million tons per annum. This is annually burned in preparation for the following crop's season. At the project site district (Northeastern side of the island), at least 435,000 tons of cane trash is available per annum. This clearly demonstrate that the biomass residue resource at the project district is 200% more than what would be consumed by the power plant if it were to fire 100% biomass residue. This is evidenced[22] by data publicly available at the Sugar Regulatory Administration of the Department of Agriculture; Philippine Sugar Millers Association and the Philippine Sugar Industries, Inc., joint studies conducted by Bronzeoak Group and Booker Tate; and recent Biomass Assessment Study conducted by Biomass Resources, Inc.

Widespread burning of cane trash after harvesting is rampant and can be observed during sugarcane harvesting season.

With these evidences, **<u>B3 therefore is the plausible baseline scenario.</u>**

The following alternatives are **<u>not</u>** plausible scenarios:

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

B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This

[22] Refer to biomass studies as mentioned earlier

applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.

B4: The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation)
B5: The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)
B6: The biomass residues are used as fertilizer
B7: The proposed project activity not undertaken as a CDM project activity (use of the biomass residues in the project plant)
B8: Any other use of the biomass residues

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

With respect to alternative scenarios for electric power, the following are identified as realistic and credible alternatives to the project activity that are consistent with current laws and regulations:

- P1: The project carried out without the CDM;
- P5: The generation of power in existing and / or new grid-connected power plants. Without the project, the grid will continue to supply a more-GHG-intensive output.

The above alternatives to the project activities are in compliance with all applicable legal and regulatory requirements - taking into account EB decisions with respect to national and/or sectoral policies and regulations in determining a baseline scenario[23] - even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution.

All the alternatives comply with all applicable legislation and regulations, hence there is no need to show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread in the country.

Philippine Policies Relevant to E+/E- Aspect of the CDM

The Philippines has, in particular, two key statutes which aim to promote energy technologies which reduce emissions. The "Renewable Energy Act of 2008 (Republic Act 9513)"[24], which was enacted to *"Encourage the development and utilization of renewable energy resources as tools to effectively prevent or reduce harmful emissions and thereby balance the goals of economic growth and development with the protection of health and the environment (Sec. 2, RA 9513)"* and the "Clean Air Act of 1999 (Republic Act 9749)", which aims to promote *"alternative fuels, processes and operating methods which will result in the eliminator or significant reduction of emissions (Sec. 11, RA 8749)."*

However, for Type E- policies, only those policies implemented before 11 November 2001 need to be taken into account when developing the baseline scenario (i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place). Hence, only the Clean Air Act of 1999 should be considered.

With respect to alternative scenarios for biomass residues, the following is identified as realistic and credible alternatives to the project activity that are consistent with current laws and regulations:

- B3: The biomass residues are burnt in an uncontrolled manner without utilizing them for

[23] Annex 3 of the 22nd EB meeting report: "Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45(e)) of the CDM Modalities and Procedures) in determining a baseline scenario (version 2)".
[24] http://www.congress.gov.ph/download/ra_14/RA09513.pdf

energy purposes.

The Clean Air Act prohibits large-scale open burning (Sec. 20). However sugarcane planters are not implementing it, and non-compliance would likely to continue as a common practice.

ACM0018 provides that:

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

A study[25] about the current practice in the region reported that: *"about three million tonnes of trash are being burned yearly, representing about 50% of all trash generated based on average estimates. Post-harvest burning is mainly done to facilitate the re-growth of the ratoon crop or the establishment of new plant cane which requires land preparation."* Considering that 50% is not a minimal percentage, it can be concluded that non-compliance with the requirement is still widespread in the country.

Outcome of Step 1b: List of alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations

Alternative scenarios P1 and P5 are in compliance with mandatory legislation and regulations. B3, on the other hand, is not eliminated from further consideration since it was shown that the applicable mandatory legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread in the country.

Step 2. Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers.

Since the proposed project activity not being registered as a CDM project activity shall be one of the considered alternatives, any barrier that may prevent the project activity to occur is included in the list. It will be shown which alternatives are prevented by at least one of the barriers previously identified and eliminate those alternatives from further consideration. All alternatives shall be compared to the same set of barriers.

If there is only one scenario alternative that is not prevented by any barrier, then this scenario alternative is identified as the baseline scenario.

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

1. For the alternative scenario *P1: The proposed project activity not undertaken as a CDM project activity*

The RE Law provides fiscal and non-fiscal incentives. The key driver is the Feed-in Tariff, of which a value of PhP 6.63/kWh[26] for biomass power plants has been recently approved by the electricity price-regulating body, the Energy Regulatory Commission (ERC). Even at this rate, the project's equity IRR

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[25] TC Mendoza, R Samson on the "Relative Bioenergy Potentials of Major Agricultural Crop Residues in the Philippines" Philippine Journal of Crop Science, 31(1): 11-28. April 2006.

[26] http://www.erc.gov.ph/cgi-bin/issuances/files/ResolutionNo.10Seriesof2012_FIT.pdf

benchmark of 20% (as evidenced by a letter from the project investors) is not met. This does not make the project financially attractive to investors and the project will not be implemented if there will be no additional income stream from CDM.

For the proposed project activity implemented without the assistance of the CDM, the Equity IRR is 17.17%. This is below the benchmark of 20% Equity IRR Benchmark, hence this is not a baseline. The Equity Benchmark is set by the investors of the project and is evidenced by a signed letter issued to the Project.

Given the period (*n*) – cash flow (C_n) pairs where *n* is a positive integer (year), the total number of periods *N* (years), and the net present value *NPV*, the internal rate of return is given by *r* in the following formula when *NPV* equals zero:

$$\mathrm{NPV} = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Table 2: Financial benefits of CDM

	Equity IRR	Remarks
P1, the proposed project activity implemented without the assistance of the CDM. Electricity price is at 6.63 pesos/kWh.	17.17%	The Equity IRR of 17.17 % is below the benchmark of 20 % Equity IRR. The high cost of investment and operation does not make the project viable even with the incentives of the RE Law, thus there is a need for additional income stream from the CDM.
The CDM Project: The proposed project activity implemented with the assistance of the CDM. Assumed CER price is US$10/CER.	19.26%	The Equity IRR of 19.26% is now nearer the benchmark Equity IRR of 20%.

2. For the alternative scenario *P5: The generation of power in the grid*

Currently, there is shortage of power in the Luzon-Visayas Grid.

From the Philippine Power Development Plan 2009-2030[27], around 17 GW of new capacities are needed to meet the demand and reserve requirements for electrical power for the country, as shown in the next table. Of these, 1,338 MW will come from committed power projects, and the remaining capacity requirements are still open for private sector participation. As can be seen below, majority of the committed projects in the Luzon-Visayas grid are coal-fired power plants.

Hence, alternative scenario P5 is not prevented by any barrier.

[27] http://www.doe.gov.ph/EP/Devp.htm

Table 4. LIST OF COMMITTED PROJECTS

Grid	Project Name	Capacity (MW)	Target Completion	Location	Proponent
Luzon	2x300MW Coal-Fired Power Plant	600	4th Qtr. Of 2012	Mariveles, Bataan	GN Power
	Sub-total Luzon	600			
Visayas	3x80MW CFB Power Plant Expansion Project	240	Unit I-March2010 Unit II-June 2010 Unit III-Jan 2011	Brgy. Daanlungsod, Toledo City, Cebu	Cebu Energy Development Corporation (Global Business Power Corp.)
	2x100MW Cebu Coal-Fired Power Plant	200	Unit 1-Feb 2011 Unit 2-May 2011	Naga, Cebu	KEPCO SPC Power Corporation (KSPC)
	17.5MW Panay Biomass Power project	17.5	2011	Brgy. Cabalabaguan, Mina, Iloilo	Green Power Panay Phils., Inc.
	Nasulo Geothermal Plant	20	2011	Nasuji, Valencia, Negros oriental	Energy development Corporation
	2x80MW CFB Power Plant	160	Unit I-Sep 2010 Unit II-Dec 2010	Brgy. Ingore, La Paz, Iloilo	Panay Energy Development Corporation (Global Business Power Corp.)
	Sub-total Visayas	638			
Mindanao	Sibulan Hydroelectric Power (Unit I-16.5MW) (Unit II-26MW)	43	Unit I-Feb2010 Unit II-Apr 2010	Sta. Cruz, Davao del Sur	Hedcor Sibulan, Inc.
	Cabulig Mini-Hydro Power Plant	8	June 2011	Plaridel, Jasaan, Misamis oriental	Mindanao Energy Systems,Inc. (MINRGY)
	Mindanao 3 Geothermal	50	July 2014	Kidapawan, North Cotabato	Energy Development Corporation
	Sub-total Mindanao	101			
Total Philippines		1,338			

Note: Mindanao 3 Geothermal Plant was moved to 2014 from its original target year of 2010

Fig. 5 List of Committed Projects, per Philippine Power Development Plan 2009-2030

For the alternative scenario B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes

The Clean Air Act prohibits large-scale open burning of cane field residues (cane trash). However, the planters do not follow this because the fields need to be cleared in preparation for the next crop's ratoon. The biomass residue in the field will be burnt by the farmers because it has no alternative use and the planters need to prepare the land for the next crop cycle. Hence, B3 is not prevented by any barrier.

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

For alternative scenario P1: An investment barrier prevents P1 to occur.
For alternative scenario P5: There is no barrier that prevents P5 to occur.
For alternative scenario B3: There is no barrier that prevents B3 to occur.

In addition, P1 has a **technological barrier**, described as follow:

The project is the first of its kind [28]in the Philippines in terms of scale (size) as a stand-alone biomass power generation plant and its multi-fuel boiler design. Most of the biomass power generation plants are cogeneration[29] and are small-scale. The boiler allows firing of multiple biomass fuel including agricultural residues that are by-nature high in alkali. The project's boiler is designed to withstand slagging and fouling. Moreover, the efficient gathering and collection of the biomass residue would entail equipment to be used in the fields, which this project will introduce[30] to the sugarcane and biomass power

[28] Refer to the Common Practice Analysis and Appendix 8 of this PDD, which shows that there is no existing multifuel biomass boiler yet in the Philippines. The list of awarded biomass contracts can be found at: http://www.doe.gov.ph/RE%20Regis&accred/Awarded%20Contracts/Biomass/Biomass.pdf
[29] http://www.doe.gov.ph/RE%20Regis&accred/Awarded%20Contracts.htm
[30] Refer to Renewable Energy Act of 2008, Section 23.

industries. The Philippine Renewable Energy Act of 2008 (Republic Act 9513) has, in fact, provided incentives that will encourage importation of such novel equipment:

> ***Renewable Energy Act of 2008, Section 21c.***
> *(a) Tax and Duty-free Importation of Components, Parts and Materials. - All shipments necessary for the manufacture and/or fabrication of RE equipment and components shall be exempted from importation tariff and duties and value added tax: Provided, however, That the said components, parts and materials are: (i) not manufactured domestically in reasonable quantity and quality at competitive prices; (ii) directly and actually needed and shall be used exclusively in the manufacture/fabrication of RE equipment; and (iii) covered by shipping documents in the name of the duly registered manufacturer/fabricator to whom the shipment will be directly delivered by customs authorities: Provided, further, That prior approval of the DOE was obtained before the importation of such components, parts and materials;*
>
> ***Renewable Energy Act of 2008, Section 22.***
> *Incentives for Farmers Engaged in the Plantation of Biomass Resources. - For a period of ten (10) years after the effectivity of this Act, all individuals and entities engaged in the plantation of crops and trees used as biomass resources such as but not limited to jatropha, coconut, and sugarcane, as certified by the Department of Energy, shall be entitled to duty-free importation and be exempted from Value-Added Tax (VAT) on all types of agricultural inputs, equipment and machinery such as, but not limited to, fertilizer, insecticide, pesticide, tractor, trailers, trucks, farm implements and machinery, harvesters, threshers, hybrid seeds, genetic materials, sprayers, packaging machinery and materials, bulk handling facilities, such as conveyors and mini-loaders, weighing scales, harvesting equipment, and spare parts of all agricultural equipment.*
>
> ***Renewable Energy Act of 2008, Section 23.***
> *Tax Rebate for Purchase of RE Components. - To encourage the adoption of RE technologies, the DOF, in consultation with DOST, DOE, and DTI, shall provide rebates for all or part of the tax paid for the purchase of RE equipment for residential, industrial, or community use. The DOF shall also prescribe the appropriate period for granting the tax rebates.*

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

The alternative scenario **P1 has an investment and technological barrier**. The investment barrier is the low Equity IRR of 17.17% which did not reach the benchmark of 20% Equity IRR. With this barrier, P1 is eliminated as a baseline scenario. CDM alleviates this situation and will increase the Equity IRR to 19.26%, which is nearer the benchmark Equity IRR of 20%. Since this scenario (P1) is eliminated, the remaining baseline scenario (P5): “The generation of power in the grid”, is therefore the baseline scenario.

Outcome of Step 2b: List of alternative scenarios to the project activity that are not prevented by any barrier

P5: The generation of power in the grid
B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes

<u>Outcome of Step 2:</u>

The methodology provides:

> ***(ACM0018, Version 2.0.0, page 14, "Outcome of Step2"):*** *"If there is only one alternative scenario that is not prevented by any barrier, and if this alternative is not the proposed project activity undertaken without being registered as a CDM project activity (P1), then this alternative scenario is identified as the baseline scenario."*

Hence, since there is only one alternative scenario that is not prevented by any barrier (P5 for electric power and B3 for biomass) and this is not the proposed project activity undertaken without being registered as a CDM project activity, then <u>P5 and B3 are the baseline scenarios</u>. The registration of the project as a CDM activity will alleviate the: a) financial barrier by raising the IRR enough to beat the benchmark, and b) technology barrier by encouraging technology transfer between countries.

<u>Step 3: Investment analysis</u>

Sub-step 3a: Determine appropriate analysis method

According to the outcome of step 2, the alternative scenario for electric power is that the equivalent electricity supply would be generated by the power grid (P5). Insofar as P5 is concerned, ACM0018 (version 02.0.0, page 15) provides:

> *"For an alternative which does not involve any investment by the project participants, use the following values for the financial indicator:*
> *• If the financial indicator is the NPV: assume a value of NPV equal to zero;*
> *• If the financial indicator is the IRR: use as the IRR the financial benchmark, as determined through the options (a) to (e) below.*
>
> *(e) Any other indicators, if the project participants can demonstrate that the above options are not applicable and their indicator is appropriately justified."*

Furthermore, the Guidance on the Assessment of Investment Analysis (EB62, annex 5, par. 19) provides:

> *"If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate."*

Based from these two excerpts, benchmark approach is appropriate, and the financial benchmark shall be derived from an indicator appropriately justified in the succeeding paragraphs.

Sub-step 3b: Apply benchmark analysis

1) Selection of appropriate benchmark

Equity Internal Rate of Return (E-IRR) is selected as the most suitable financial indicator, since the investment decision of the project owner and investors are based on the expected E-IRR of the project activity.

The E-IRR of the Project must be above a minimum level, or benchmark level, required by the project owner and other investors. Given that the Project could be developed by other entities apart from the project owner, a publicly available benchmark E-IRR that would apply to investors generally is determined and applied here.

In accordance with the Guidelines on the Assessment of Investment Analysis, Version 05, EB62, paragraph 15:

> *"If the benchmark is based on parameters that are standard in the market, the cost of equity should be determined either by: (a) selecting the values provided in Appendix A; or by (b) calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors."*

Option (b) is chosen. A new benchmark has been developed through the following means:

1. Third party, reputable and independent publications that report required returns on equity for investments in emerging markets.
2. Required return on equity of investments in emerging markets as reported by pertinent investment banks and funds.
3. Calculating the cost of equity based on the principles of the Capital Asset Pricing Model (CAPM) using Philippines bond and stock market data. All the data is available publicly and has been assessed and utilised by the Energy Regulatory Commission of the Philippines.

Based on the above strategies, the appropriate post-tax Equity IRR benchmark for the project is [20%] real.

Third Party Research Reports

- United Nations Environmental Programme: Private Financing of Renewable Energy – A Guide for Policy Makers[31] (co-produced by UNEP Sustainable Energy Finance Initiative, Bloomberg Energy Finance and Chatham House) states that private equity funds typically require an IRR of > 25%.
- A valuation of power companies in the Philippines by RCBC Securities, Inc shows an expectation that returns on equity in the sector will average 19.6%-21.9% in the period 2011-2013.[32]

Investment Funds and Investment Banks

- Maybank MEACP is a recently launched clean energy master fund managed out of Singapore and targeting renewable energy investments in the Philippines as well as elsewhere in Asia. The fund has stated that equity returns need to be in the high teens for investments into businesses with existing operating assets[33], where risk diversification exists. Accordingly required returns into single project companies need to be higher to reflect the commensurately higher risk.
- Thomas Lloyd Capital LLC, advisor to San Carlos BioPower, provided a written statement that investors would seek returns in excess of 20% for single project investments such as the San Carlos BioPower project.[34] This has been borne out in discussions with potential investors in the project who seek sufficient return to compensate for the risks of investing in a single-asset company.

Theoretical Required Rate of Return on Equity Using Capitalized Asset Pricing Model

The theoretical cost of equity using the CAPM model was determined by the Philippine Energy Regulatory Commission in July 2012 based on the following equation:

$$r_e = r_f + Beta_e \times MRP$$

[31] http://cleanenergysolutions.org/node/2665
[32] http://www.rcbcsec.com/secured/admin/download/August%2024%202012%20Valuation.pdf
[33] http://www.greenprospectsasia.com/content/maybank-meacp-stays-dollars-sense-and-profitability
[34] Letter dated 31 August 2011 to SC BioPower Inc from Thomas-Llloyd Capital LLC

Where:

r_e	=	nominal cost of equity
r_f	=	risk free rate estimated for the Philippines, which was assumed to be 6% based on 10 year yields on Philippine bonds
$Beta_e$	=	equity beta for benchmark generation company, calculated as 1.03 on an unlevered basis from the betas of comparable companies provided by Professor Aswath Damodaran of New York University, Stern[35]
MRP	=	Market Risk Premium, calculated based on a measure of Country Risk Premium provided by Professor Aswath Damodaran of New York University, Stern[36] from data published in January 2012. Professor Stern estimates the Philippines to have a CRP of 4.13% and a Total Risk Premium of 10.13% based on a default spread of 275 basis points and a country rating by Moodys of Ba2. This gives a total Market Risk Premium of 10.13%.

This calculation provides a computed cost of equity as 16.44% for the Philippines. This was confirmed by ERC in its recent decision on the establishment of Feed in Tariff levels for the Philippines.[37] However, the ERC acknowledged that the calculation didn't properly reflect the risks associated with biomass renewable energy projects and decided to adopt a cost of equity risk premium for biomass projects of 0.56%, giving an all-in cost of equity for biomass investments of 17%.[38].

Notwithstanding the above, there is disagreement about the actual cost of equity capital in the Philippines energy market, with the National Renewable Energy Board advocating 18.5% for biomass investments and other active investors in the market calculating CAPM-based rates of 19.28% in their submissions to the ERC.[39]

Project Risks

The benchmarks calculated above are based on market data. The Philippine stock market consists of Publicly Listed companies which are relatively large and diversified operationally and financially. As such the average realised cost of equity for these listed companies is likely to be less for such companies than for individual projects, particularly green field projects. Thus a premium for greenfield project risk should be incorporated into the final benchmark. Based on discussions with potential third party equity investors into the San Carlo BioPower project, a premium of 3% on top of the ERC published cost of equity is required.

Final Benchmark

Whilst a computed cost of equity based on CAPM methodologies generates a range of cost of equity rates for biomass investments from 17% to 19.28%, it is also evident that competing equity investment opportunities in diversified Philippine power companies support the assertion that a 20% return on equity is required to attract investment into a single project power company. Accordingly, the appropriate equity benchmark is 20% real.

2) IRR of the project activity

Comparison of IRR with and without CDM revenues

	Without CDM	Benchmark	With CDM
IRR	17.17%	20%	19.26%

35 ERC Case No. 2011-138 RC Decision
36 ERC Case No. 2011-138 RC Decision
37 http://www.erc.gov.ph/cgi-bin/issuances/files/Decision_ERCCaseNo.2011-006RM_NREB_pp81-90.pdf
38 http://www.erc.gov.ph/cgi-bin/issuances/files/Decision_ERCCaseNo.2011-006RM_NREB_pp81-90.pdf;
39 http://www.erc.gov.ph/cgi-bin/issuances/files/Decision_ERCCaseNo.2011-138RC_SOCOTECO_SECpp41-75.pdf; page 59 of 75

Sub-step 3c: Sensitivity Analysis

The Scenario P1: Project carried out without the CDM, is not financially attractive based on the Investment Analysis and therefore is not considered as a Baseline scenario.
Baseline scenarios considered:

1. Scenario (P5): The generation of power in existing and/or new grid-connected power plants
2. Scenario B3: biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes

To further show that the conclusion that **Scenario P1: Project carried out without CDM** is **not** the baseline and holds true for reasonable variations in the input parameters, a sensitivity analysis was carried out by introducing changes to the following critical assumptions.

SENSITIVITY CASES of Equity IRR, 20 years					
Equity IRR / Variation Rate / Parameter	-10%	-5%	0%	5%	10%
Electricity tariff	10.74%	13.97%	17.17%	20.41%	23.68%
Biomass fuel cost	19.02%	18.10%	17.17%	16.25%	15.32%
Annual operating hours	10.74%	13.97%	17.17%	20.41%	23.68%
O & M Costs (except fuel cost)	18.77%	17.97%	17.17%	16.37%	15.57%
Total static investment cost	20.23%	18.62%	17.17%	15.86%	14.67%

Electricity Tariff

The electricity tariff has to increase by 5% in order to reach the IRR of 20.41%. This is not possible since the ERC on June 27, 2012 has set the Feed-in-Tariff (FIT) for biomass projects at 6.63 peso/kWh for the next 20 years, and applicable to projects that will come online three years from FITimplementation. ERC provided for reductions on FIT over time on the basis of a 0.5% degression rate two years from the effectivity of FIT per FIT Rules[40]. Based on this ERC decision the 5% increase in FIT is not possible, as tariff will be decreasing.

Biomass fuel cost

The IRR is not sensitive to 10% reduction on biomass fuel cost. It will require 15.25% price reduction in order to reach the 20% benchmark which is not realistic with the upward trend in Consumer Price Index[41].

Annual operating hours

The annual operating hours has to increase by 5% to reach 20.41% IRR. This is not possible because adding 5% to 7,884 hours will result to 8,270 hours, which is above the maximum guaranteed hours of 8,200 hours. An additional 5% (394 hours) on the projected 7884 hours of operation per annum, assuming 438 hours of planned shutdown for maintenance, means it will exceed the plant's maximum availability of 8,200 hours. This is not realistic.

O&M Costs (excluding fuel cost)

The O&M cost will still not reach the benchmark of 20% even if it is decreased by 10%. This shows that the IRR is not sensitive to the O&M cost.

[40] http://www.erc.gov.ph/cgi-bin/issuances/files/ResolutionNo.10Seriesof2012_FIT.pdf
[41] www.nscb.gov.ph/secstat/d_price.asp

Static Investment Cost

A reduction of 10% on the entire static investment cost is not likely since the EPC Contract has been signed at a fixed cost. The EPC Contract comprises 49% of the static cost. Therefore a reduction of 10% of the total static investment cost translates into a decrease by approximately 20% in all the non-EPC cost items before the benchmark return is reached. This is not considered feasible.

The threshold values of key parameters are given below.

Sensitivity to Reach Benchmark	Base Case	Benchmark
1. Electricity Generation, kWh	127,011,240	132,548,930
% from base	0%	4.36%
Equity IRR, 20 years	**17.17%**	**20.00%**
2. Fuel Cost (20-yr average), kPesos/yr	370,739	314,201
% from base	0%	-15.25%
Equity IRR, 20 years	**17.17%**	**20.00%**
3. Electricity Price, Pesos/kWh	6.630	6.9191
% from base	0%	4.36%
Equity IRR, 20 years	**17.17%**	**20.00%**
4. Project Cost, 1000 Pesos	2,972,381	2,695,355
% from base	0%	-9.32%
Equity IRR, 20 years	**17.17%**	**20.00%**

The results of the investment analysis show that without CDM, the 20% benchmark Equity IRR will not be reached. With CDM, the Equity IRR is now nearer the benchmark, therefore CDM alleviated the barrier and the Project Activity is additional.

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

P1 – is the least economically attractive as shown above, the IRR of 17.17% did not reach the 20% benchmark. Therefore **this is not the baseline**.

P5 - is the most economically attractive as this will not require any investment from the project proponent (PP), therefore, this is considered as the baseline, per ACM0018, Version 02.0.0, page 15:

"If the investment analysis, supported by the sensitivity analysis, is conclusive, then the most economically or financially attractive alternative scenario is considered as baseline scenario".

B3: biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes, will not require any investment from the project proponent (PP), therefore, this is considered as the baseline, per ACM0018, Version 02.0.0, page 15. This is also the only remaining scenario.

Therefore, **P5 and B3 are the baseline scenarios.**

Step 4: ***Common practice analysis***

A summary of the relevant biomass projects[42] in the Philippines are given in the following table. The complete list can be found in Appendix 8.

[42] http://www.doe.gov.ph/RE%20Regis&accred/Awarded%20Contracts.htm

Power plants with installed capacity and awarded with Biomass Renewable Energy Operating Contract (BREOC)	**Fuel**	**Installed Capacity (MW)**	**Included in the common practice analysis?**
7.2 MW Rice Hull Gasification (Isabela)	Rice hull	3.6	Included
12.5 MW Bataan 2020 Rice hull-fired Cogeneration Plant (Bataan)	Rice hull	12.5	Excluded (CDM-registered, Ref # 3424)
Excel Farm Methane Recovery and Electricity Generation Project (Bulacan)	Biogas	0.2	Excluded (CDM-registered, Ref # 2289)
0.9 MW RF#12 Biogas Power Generation System (Bulacan)	Biogas	0.9	Excluded (CDM-registered, Ref # 3930)
Amigo Farm Methane Recovery and Electricity Generation Project (Bulacan)	Biogas	0.15	Excluded (CDM-registered project, Ref # 2276)
4 MW San Pedro Landfill Methane Recovery and Electricity Generation (Laguna)	Biogas	4	Included
14.8 MW Montalban Landfill Methane Recovery and Electricity Generation (Rizal)	Biogas	14.8	Excluded (CDM-registered, Ref # 1853)
1.2 MW Payatas Landfill Methane Recovery and Power Generation Facility (Quezon City)	Biogas	0.2	Excluded (CDM-registered, Ref # 1258)
15 MW CASA Bagasse-Fired Cogeneration Facility (Iloilo)	Bagasse	15	Included
8 MW SCBI Bagasse Cogeneration Plant (Negros Occidental)	Bagasse	8	Excluded (CDM-registered, Ref # 0931)

21 MW FFHC Bagasse Cogeneration System (Negros Occidental)	Bagasse	21	Excluded (CDM-registered, Ref # 1750)
26 MW VMCI Bagasse-Fired Cogeneration Plant (Negros Occidental)	Bagasse	18	Included
21 MW CSCI Bagasse-Fired Cogeneration Facility (Bukidnon)	Bagasse	21	Included

Based from the preceding table, it can be gleaned that: 1) There is no power plant yet which utilizes cane trash as fuel, and 2) There is no power plant yet which employs a multifuel boiler.

There are four prospective multifuel biomass projects --- one in Nueva Ecija (Green Power Nueva Ecija Phils. Inc.), one in Aklan (Asea One Power Corp.), and two in Iloilo (Asea One Power Corp. and Green Power Panay Phils., Inc). A summary of these prospective projects are given below.

Prospective multifuel biomass projects[43]	**Location**[44]	**Project Status**[45]	**Fuel**
17.5 MW Nueva Ecija Multi-Fuel Biomass Power Generation Facility *(Green Power Nueva Ecija Phils, Inc.)*	Nueva Ecija (island of Luzon)	No installed capacity yet	rice straw and husks, corn straw and cobs, sugar cane tops and leaves, coconut wastes[46] Note: The province of Nueva Ecija, however, is not known as a sugarcane producer.[47]
12 MW Aklan Multi-Fuel Biomass Power Plant *(Asea One Power Corp.)*	Aklan (island of Panay)	No installed capacity yet	Mainly rice husks[48]
30 MW Ajuy Multi-Fuel Biomass Power Generation Project *(Asea One Power Corp.)*	Iloilo (island of Panay)	No installed capacity yet	rice stalks, rice husks and wood chips such as sibucao and madre de cacao, bagasse from muscovado and coconut husks[49]

[43] See Appendix 8.
[44] See Appendix 8.
[45] See Appendix 8.
[46] http://www.green-power-nuevaecija.com/
[47] http://www.sra.gov.ph/archive_stat/upd_Farms%20by%20farm%20size.pdf
[48] http://www.neda-rdc6.ph/site/rpmc6/on_PowGen_Biomass-ASEA.pdf
[49] http://www.alternat1ve.com/biofuel/2008/12/19/asea-one-power-corp-announces-biomass-energy-plants/

30 MW Ajuy Multi-Fuel Biomass Power Generation Project *(Green Power Panay Phils, Inc.)*	Iloilo (island of Panay)	No installed capacity yet	Rice husks, rice straws, corn cobs, corn straws[50]
18 MW San Carlos Biopower Power Plant	San Carlos (island of Negros)	No installed capacity yet	Mainly cane trash

In terms of geographical area, the project activity is the only one that is to be located in the island of Negros. All other prospective multifuel biomass boilers are planned to be located in other islands. In terms of the type of fuel, only the project activity will utilize cane trash as primary fuel.

Moreover, no one in the Philippines collects cane trash for fuel utilization because it is characterized as (1) low-density biomass making it not feasible to haul from long distance due to transport cost; and (2) the high-alkali [51]nature of the material prevents the existing boilers of the sugar mills to utilize it as fuel because it will cause slagging[52] and fouling.

Outcome of Step 4
The project activity is not a common practice and will be a pioneering activity in the field of straight-power (power-only) generation. Therefore the project activity is **additional**.

B.5. Demonstration of additionality

Demonstration of additionality has been covered in the discussion under B.4.

Furthermore, the Philippines is a signatory to the Kyoto Protocol. While the Philippines considers its GHG contributions to the atmosphere as insignificant, the climate change issue affects all facets of the country's development. In view of this, the Philippines aligned itself with more than 150 countries under the UNFCCCC process, signed the Convention on 12 June 1992 and ratified it on 2 August 1994. The Philippine Government likewise signed the Kyoto Protocol on 15 April 1998 and ratified it on 22 November 2001. As a country Party to the UNFCCC and signatory to its Kyoto Protocol, the Philippines intends to remain an engaged stakeholder toward combating and adapting to climate change, with a particular emphasis on alleviating poverty and advancing sustainable development.

Table 3: Prior Consideration of CDM

February 2009	Feasibility Study Report (FSR)
3 July 2009	Consultation with the Barangay Officials
28 July 2009	Consultation with City Officials
March 2011	Contract signing with SEEDLinks Philippines, Inc. as CDM Consultant
22 March 2011	CDM Prior Consideration Form submitted to the DNA
22 July 2011	Stakeholders Consultation
23 July 2011	Consultation with the City Councilors

[50] http://202.57.47.221/internal/Secured/Uploads/ECC/0ddd3bb7-9716-417b-9bf9-73843d10091b.pdf
[51] Refer to footnote 20
[52] Refer to footnote 21

10 August 2012	EPC contractor Equipment contract Awarding/signing
	Status: Secured majority of the permits and licenses; Equity committed and Project Finance under due diligence

Based on the analysis in B.4 and the above timeline, which shows prior CDM consideration, the CDM was a serious consideration in the decision to proceed with the project and the proposed project is **additional.**

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Summary of Calculations of Emission Reductions (ER) using ACM0018 version 02.0.0. Only equations that are applicable will be included.

Emission Reductions

$ER_y = BE_y - PE_y - LE_y$ **(Equation 1 of ACM0018, version 02.0.0)**

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

Baseline Emissions (BE)

Baseline emissions are calculated as follows:

$BE_y = BE_{EL,y} + BE_{BR,y}$ **(Equation 2 of ACM0018, version 02.0.0)**

Where:
BE_y *Baseline emissions in year y* (tCO_2)
$BE_{EL,y}$ *Baseline emissions due to generation of electricity in year y* (tCO_2)
$BE_{BR,y}$ *Baseline emissions due to uncontrolled burning or decay of biomass residues in year y* (tCO_2)

Baseline emissions are determined through the following steps:

Step 1: Determination of $BE_{EL,y}$

Baseline emissions from electricity generation are calculated based on the net quantity of electricity generated at the project site under the project scenario ($EG_{PJ,y}$) and a baseline emission factor ($EF_{BL,EL,y}$) which expresses the weighted average CO_2 intensity of electricity generation in the baseline, as follows:

$BE_{EL,y} = EG_{PJ,y} * EF_{BL,EL,y}$ **(Equation 3 of ACM0018, version 02.0.0)**

Where:
$BE_{EL,y}$ *Baseline emissions due to generation of electricity in year y* (tCO_2)
$EG_{PJ,y}$ *Net quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh)*

$EF_{BL,EL,y}$ *Emission factor for electricity generation in the baseline in year y (tCO_2/MWh)*

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

Step 1.1: Determination of $EG_{PJ,y}$

The net quantity of electricity generated in all power plants which are located at the project site and included in the project boundary ($EG_{PJ,y}$) is determined as the difference between the gross electricity generation at the project site ($EG_{PJ,gross,y}$) and the auxiliary electricity consumption required for the operation of the power plants at the project site ($EG_{PJ,aux,y}$), as follows:

$EG_{PJ,y} = EG_{PJ,gross,y} - EG_{PJ,aux,y}$ **(Equation 4 of ACM0018, version 02.0.0)**

Where:

$EG_{PJ,y}$	*Net quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh)*
$EG_{PJ,gross,y}$	*Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh)*
$EG_{PJ,aux,y}$	*Total auxiliary electricity consumption required for the operation of the power plants at the project site (MWh)*

Step 1.2: Determination of $EF_{BL,EL,y}$

The methodology provides the following equation to calculate $EF_{BL,EL,y}$

$$EF_{BL,EL,y} = \frac{EG_{BL,FF,y} \cdot EF_{BL,FF,y} + EG_{BL,grid,y} \cdot EF_{grid,CM,y} + EG_{BL,FF/grid,y} \cdot MIN\left(EF_{BL,FF,y}; EF_{grid,CM,y}\right)}{EG_{BL,BR,y} + EG_{BL,FF,y} + EG_{BL,grid,y} + EG_{BL,FF/grid,y}}$$

(Equation 5 of ACM0018, version 02.0.0)

Where:

$EF_{BL,EL,y}$ = *Emission factor for electricity generation in the baseline in year y (tCO_2/MWh)*
$EG_{BL,BR,y}$ = *Amount of electricity that would be generated with biomass residues in poweronly plants operated at the project site in the baseline in year y (MWh)*
$EG_{BL,FF,y}$ = *Minimum amount of electricity that would be generated with fossil fuels at the project site in the baseline in year y (MWh)*
$EG_{BL,grid,y}$ = *Minimum amount of electricity that would be generated by power plants in the electricity grid in the baseline in year y (MWh)*
$EG_{BL,FF/grid,y}$ = *Amount of electricity that could be generated in the baseline either by power plants in the electricity grid or by power plants at the project site using fossil fuels in year y (MWh)*
$EF_{grid,CM,y}$ = *Combined margin CO_2 emission factor for grid-connected electricity generation in year y (tCO_2/MWh)*
$EF_{BL,FF,y}$ = *CO_2 emission factor for electricity generation with fossil fuels in power plant(s) at the project site in the baseline in year y (tCO_2/MWh)*

Step 1.3: Determination of $EG_{BL,BR,y}$

The methodology provides two cases under Step 1.3, depending on whether B4 applies as a baseline

scenario.

Case 1: No power generation with biomass residues in the baseline.
Case 2: Power generation with biomass residues in the baseline.

Since the baseline scenario for biomass is B3 and not B4, **case 1 applies**. Hence, as provided for by the methodology,

$$EG_{BL,BR,y} = 0$$

Step 1.4: Determination of $EG_{BL,FF,y}$

The methodology provides four cases under Step 1.4, in relation to the use of fossil fuels in the baseline.

Case 1: No use of fossil fuels in the baseline.
Case 2: No connection to the electricity grid.
Case 3: Grid connection and historical use of fossil fuels.
Case 4: Grid connection, no historical use of fossil fuels, and construction of a new power plant (co-)fired with fossil fuels in the baseline scenario.

Since no fossil fuel would be used for electricity generation in the baseline scenario at the project site, **case 1 applies**. Hence, as provided for by the methodology,

$$EG_{BL,FF,y} = 0.$$

Step 1.5: Determination of $EG_{BL,grid,y}$

The methodology provides five cases under Step 1.5, in relation to the minimum amount of electricity that would be generated by power plants in the electricity grid in the baseline.

Case 1: No connection to the electricity grid.
Case 2: No electricity generation at the project site in the baseline.
Case 3: Use of only biomass residues for electricity generation at the project site in the baseline.
Case 4: Use of only fossil fuels for electricity generation at the project site in the baseline.
Case 5: Use of fossil fuels and biomass residues for electricity generation at the project site in the baseline.

Since no power plants would be operated at the project site in the baseline, then all electricity generated by the project displaces grid electricity and **case 2 applies**. Hence, as provided for by the methodology,

$$EG_{BL,grid,y} = EG_{PJ,y}$$

Step 1.6: Determination of $EG_{BL,FF/grid,y}$

$EG_{BL,FF/grid,y}$ represents the amount of electricity that could be generated in the baseline in the grid or at the project site using fossil fuels. $EG_{BL,FF/grid,y}$ is calculated as follows:

$$EG_{BL,FF/grid,y} = EG_{PJ,y} - EG_{BL,BR,y} - EG_{BL,FF,y} - EG_{BL,grid,y}$$

(Equation 23 of ACM0018, version 02.0.0)

Where:

$EG_{BL,FF/grid,y}$ = Amount of electricity that could be generated in the baseline either by power plants in the electricity grid or by power plants at the project site using fossil fuels in year y (MWh)

$EG_{PJ,y}$ = Electricity generated in power plants included in the project boundary in year y (MWh)

$EG_{BL,BR,y}$ = Amount of electricity that would be generated with biomass residues in power-only plants operated at the project site in the baseline in year y (MWh)

$EG_{BL,FF,y}$ = Minimum amount of electricity that would be generated with fossil fuels at the project site in the baseline in year y (MWh)

$EG_{BL,grid,y}$ = Minimum amount of electricity that would be generated by power plants in the electricity grid in the baseline in year y (MWh)

From the results of step 1.3, 1.4 and 1.5,

$$EG_{BL,FF/grid,y} = EG_{PJ,y} – 0 – 0 – EG_{PJ,y}$$

Hence,

$$EG_{BL,FF/grid,y} = 0$$

Step 1.7: Determination of $EF_{BL,FF,y}$

This step is only applicable if fossil fuel power plants were operated at the project site prior to the implementation of the project activity. According to the analysis of baseline scenario in section B.4, the project is a newly built power-only project and no power plants were operated at the project site prior to the implementation of the project in the baseline scenario. Hence, this step is not applicable.

Step 1.8: Determination of $EF_{grid,CM,y}$

$EF_{grid,CM,y}$ is determined as the combined margin CO_2 emission factor for grid connected power generation in year y, calculated using the latest approved version (Version 03.0.0) of the ‘Tool to calculate the emission factor for an electricity system’.

The details of the calculations for the **$EF_{grid,CM,y}$** is described in detail in Annex 3 of this PDD.

Calculate $BE_{EL,y}$

Substitute the values of $EG_{PJ,y}$ and $EF_{BL,EL,y}$ to Equation 3:

$BE_{EL,y} = EG_{PJ,y} \times EF_{BL,EL,y}$ **(Equation 3 of ACM0018, version 02.0.0)**

Step 2: Determination of baseline emissions due to uncontrolled burning of biomass residues (sugar cane trash only for this project), ($BE_{BR,y}$)

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

Baseline emissions due to uncontrolled burning or decay of biomass residues are only determined for those categories of biomass residues for which B1, B2 or B3 has been identified as the most plausible baseline scenario, as summarized in Table 2. The guidance for the determination of $BR_{BL,n,p,y}$ should be considered in determining the quantities of biomass residues for each biomass residue category.

The emissions are determined separately for biomass residues categories for which scenarios B1 and B3 (aerobic decay or uncontrolled burning) apply, and for biomass residues categories for which scenario B2 (anaerobic decay) apply:

$BE_{BR,y} = BE_{BR,B1/B3,y} + BE_{BR,B2,y}$

(Equation 25 of ACM0018, version 02.0.0)

Where:

$BE_{BR,y}$	*Baseline emissions due to decay of biomass residues in year y (tCO_2)*
$BE_{BR,B1/B3,y}$	*Baseline emissions due to aerobic decay of biomass residues in year y (tCO_2)*
$BE_{BR,B2,y}$	*Baseline emissions due to anaerobic decay of biomass residues in year y (tCO_2)*

There will be no emission from anaerobic decay of biomass, as this is ruled out as baseline scenario, B3. **So $BE_{BR,B2,y}$ is zero.**

Therefore:

$BE_{BR,y} = BR_{BR,B1/B3,y}$

Step 2.1: Determination of $BE_{BR,B1/B3,y}$

For the biomass residues categories, as described in the biomass residues categories table, for which the most likely baseline scenario is burnt in an uncontrolled manner without utilizing them for energy purposes (B3), baseline emissions are calculated assuming, (for uncontrolled burning), that the biomass residues would be burnt in an uncontrolled manner.
Baseline emissions are calculated by multiplying the quantity of biomass residues with the net calorific value and an appropriate emission factor, as follows:

$BE_{BR,B1/B3,y} = GWP_{CH4} * \sum BR_{n,B1/B3,y} * NCV_{n,y} * EF_{BR,n,y}$

(Equation 26 of ACM0018, version 02.0.0)

Where:

$BE_{BR,B1/B3,y}$	*Baseline emissions due to uncontrolled burning or anaerobic decay of biomass residues in year y (tCO_2)*
GWP_{CH4}	*Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4)*
$BR_{n,B1/B3,y}$	*Amount of biomass residues category n used in the project plant(s) included in the project boundary in year y for which B3 has been identified as the most plausible baseline scenario (tonnes on dry-basis)*
$NCV_{n,y}$	*Net calorific value of the biomass residues category n in yeay y (GJ/tonnes on dry-basis)*
$EF_{BR,n,y}$	*CH4 emission factor for uncontrolled burning of the biomass residues category n during the year y (tCH4/GJ)*
n	*Categories of biomass residues*

Step 2.2: Determination of $BE_{BR,B2,y}$

Since there will be no emission from anaerobic decay of biomass, as this is ruled out as baseline scenario, **$BE_{BR,B2,y}$ is zero.**

Project Emission (PE)

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{EL,y} + PE_{TR,y} + PE_{BR,y} + PE_{ww,y}$$

(Equation 27 of ACM0018, version 02.0.0)

Where:

PE_y	*Project emissions during year y (tCO_2)*
$PE_{FF,y}$	*Emissions during the year y due to fossil fuel consumption (tCO_2)*
$PE_{EL,y}$	*Emissions during the year y due to electricity use off-site for the processing of biomass residues (tCO_2)*
$PE_{TR,y}$	*Emissions during the year y due to transport of the biomass residues to the project plant (tCO_2)*
$PE_{BR,y}$	*Emissions from the combustion of biomass residues during the year y (tCO_2)*
$PE_{WW,y}$	*Emissions from waste water generated from the treatment of biomass residues in year y (tCO_2)*

Determination of $PE_{FF,y}$

Fossil fuel will not be used in the project activity therefore $PE_{FF,y} = 0$. This parameter will be monitored.

Determination of $PE_{EL,y}$

No off-site processing of biomass will take place in the project activity therefore $PE_{EL,y} = 0$.

Determination of $PE_{TR,y}$

Using "Project and leakage emissions from road transportation of freight (EB63, Annex 10) Version 01.0.0":

$$\left.\begin{matrix} PE_{TR,m} \\ LE_{TR,m} \end{matrix}\right\} = \sum_f D_{f,m} \cdot FR_{f,m} \cdot EF_{CO2,f} \cdot 10^{-6}$$

(Equation 1 of the tool "Project and leakage emissions from road transportation of freight")

Where:

$PE_{TR,m}$	*Project emissions from road transportation of freight monitoring period m ($t\ CO_2$)*
$LE_{TR,m}$	*Leakage emissions from road transportation of freight monitoring period m ($t\ CO_2$)*
$D_{f,m}$	*Return trip road 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 ($g\ CO_2$ / t km)*
f	*Freight transportation activities conducted in the project activity in monitoring period m*

Where the default emission factor values according to the tool are as follow:

Vehicle class	Emission factor ($g\ CO_2$ / t km)
Light vehicles	245
Heavy vehicles	129

Determination of $PE_{BR,y}$

Using Equation 28, ACM0018 version 02.0.0,

$PE_{BR,y} = GWP_{CH4} * EF_{CH4,BR} \sum BR_{PJ,n,y} * NCV_{n,y}$

(Equation 28 of ACM0018, version 02.0.0)

Where:

$PE_{BR,y}$	*Emissions from the combustion of biomass residues during the year y (tCO_2)*
GWP_{CH4}	*Global Warming Potential for methane valid for the relevant commitment period (tCO_2/tCH_4)*
$EF_{CH4,BR}$	*CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ)*
$BR_{PJ,n,y}$	*Quantity of biomass residues of category n used in power plants which are located at the project site and included in the project boundary in year y (tonnes on dry-basis/yr)*
$NCV_{n,y}$	*Net calorific value of the biomass residues category n in year y (GJ/tonnes on dry-basis)*

Determination of $PE_{ww,y}$

The biomass residues will not require specific treatment before combustion therefore $PE_{ww,y}$ is not included, $PE_{ww,y} = 0$

Since $PE_{FF,y} = 0$, $PE_{EL,y} = 0$ and $PE_{ww,y} = 0$

Therefore,

$\mathbf{PE_y = PE_{TR,y} + PE_{BR,y}}$

Leakage Emission

$\mathbf{LE_y = EF_{CO2,LE} \bullet \sum BR_{PJ,n,y} \bullet NCV_{n,y}}$
(Equation 30 of ACM0018, version 02.0.0)

Where:

LE_y	*Leakage emissions in year y (tCO_2/yr)*
$EF_{CO2,LE}$	*CO_2 emission factor of the most carbon intensive fossil fuel used in the country (tCO_2/GJ)*
$BR_{PJ,n,y}$	*Quantity of biomass residues of category n used in power plants which are located at the project site and included in the project boundary in year y (tonnes on dry-basis/yr)*
$NCV_{n,y}$	*Net calorific value of the biomass residues category n in year y (GJ/ton of dry matter)*
n	*Categories of biomass residues for which B5:, B6:, B7: or B8: has been identified as the baseline scenario*

Equation 30 is applied in calculating the leakage emission for categories of biomass residue whose baseline scenario has been identified as B5, B6, B7, or B8. Since the biomass baseline is B3, leakage emission is not included. Therefore $LE_y = 0$.

B.6.2. Data and parameters fixed ex ante

Data / Parameter:	$\mathbf{GWP_{CH4}}$
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH_4
Source of data used:	IPCC

Value Applied	21 for the first commitment period.
Choice of data or Measurement methods and procedures	No national default value, hence the use of the IPCC value
Purpose of data	Calculation of baseline emissions
Additional comment:	Shall be updated according to any future COP/MOP decisions. As stated in ACM0018 version 02.0.0

Data / Parameter:	$EF_{BL,EL,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor for electricity in the baseline in year y. In this project the Luzon-Visayas grid is used based on the latest 2011 net generation data from the Philippine Department of Energy.
Source of data used:	Computations using the latest 2011 net generation data from the Philippine Department of Energy and using the latest "Tool to calculate the emission factor for an electricity system".
Value Applied	0.494
Choice of data or Measurement methods and procedures	Used by SEEDLinks Philippines, Inc. on a project undergoing final validation. Computations using the latest 2011 net generation data from the Philippine Department of Energy and using the latest "Tool to calculate the emission factor for an electricity system".
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	Biomass residues categories and quantities used for the selection of the baseline scenario selection and assessment of additionality
Data unit:	Type (i.e. bagasse, rice husks, empty fruit bunches, etc.); •Source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.); •Fate in the absence of the project activity (Scenarios B); •Use in the project scenario (Scenarios P); •Quantity (tonnes on dry-basis)
Description:	Explain and document transparently in the CDM-PDD, using a table similar to Table 2, which quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their baseline scenario. The last column of Table 2 corresponds to the quantity of each category of biomass residues (tonnes). For the selection of the baseline scenario and demonstration of additionality, at the validation stage, an *ex ante* estimation of these quantities should be provided.

Biomass Residue category (*k*)	**Type**	**Source**	**Fate in the Absence of the Project Activity**	**Use in Project Scenario**	**Quantity (tonnes)**
1	Cane trash	Off-site	Burned	Used as fuel for electricity generation	80,217 (year 1)

	2	CTS Thinnings/ harvest wastes	Off-site	Burned	Used as fuel for electricity generation	56,550 (year 1)
	3	Other agricultural residues (coconut husks and shells, corn cobs, rice straw)	Off-site	Burned	Used as fuel for electricity generation	6,088 (year 1)
	4	Woody ECP	Offsite	-	Used as fuel for electricity generation	0 (year 1)
	5	Grassy ECP	Offsite	-	Used as fuel for electricity generation	3,100 (year 1)

Source of data used:	On-site assessment of biomass residues categories and quantities as reflected in the Feasibility Study and Project's Biomass Assessment Studies
Value applied:	Please refer to the table above
Choice of data or Measurement methods and procedures	For cane trash, actual studies on cane residue collection were used and this was verified by publicly available information from the SRA. As for other agri crops, the productivity levels of other crops is publicly available and the biomass residue were determined using Product Residue Ratio from peer-reviewed publications.
Purpose of data:	Calculation of baseline emissions
Additional comment:	This parameter is related to the procedure for the selection of the baseline scenario selection and assessment of additionality

Data / Parameter:	$BR_{n,p,y}$
Data unit:	tonnes on dry-basis
Description:	Quantity of biomass residues of category *n* used in year *y* in power plant *p*
Source of data used:	Project's Feasibility Study and Biomass Assessment Studies
Value applied:	**BE1 -Biomass Fuel Mix at the Boiler-in-Take (BIT) Quantity** (see table below) For years 1 to 7, please see Attachment 1.

BE1 -Biomass Fuel Mix at the Boiler-in-Take (BIT) Quantity

Type of Biomass Fuel	Y1
Sugar Cane Trash	80,217
Woody Energy Crop Plantations (ECP)	-
Grassy Energy Crop Plantations (ECP)	3,100
Woody residues/thinnings from Current Tree Stands (CTS)	56,550
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	6,088
TOTAL	145,956

For years 1 to 7, please see Attachment 1.

Choice of data or Measurement methods and procedures:	The Delivered Quantity is the same quantity estimated to be gathered from the field by use of weight meters. The average MC was pre-determined using moisture meters/ lab. The Biomass at BIT is estimated by calculation using delivered weight and pre-determined MC for each type of biomass
Measurement procedures (if any)	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts (if available).
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	$EG_{p,y}$
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in power plant *p* in year *y*
Source of data used:	Calculated
Value applied:	127,011.24
Choice of data or Measurement methods and procedures:	Calculated based on equipment specifications and manufacturer's warranty
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	$NCV_{n,y}$
Data unit:	GJ/tons on a dry basis
Description:	Net calorific value of biomass residue category *n* in year *y*
Source of data used:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default net calorific values (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the values in a conservative manner and justify the choice
Value Applied:	(see table below)
Choice of data or Measurement methods and procedures:	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Net Calorific Value of Biomass Residues

Type of Biomass Fuel	NCV	Unit
Cane Trash	0.01030	TJ/Ton
Woody Energy Crop Plantations (ECP)	0.01210	TJ/Ton
Grassy Energy Crop Plantations (ECP)	0.01025	TJ/Ton
Woody residues/thinning	0.01210	TJ/Ton
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	0.01282	TJ/Ton

Data / Parameter:	$EF_{BL,CO2,FF,d}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline
Source of data used:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default emission factors (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the value in a conservative manner and justify the choice
Value Applied:	Please refer to Annex 3 and Attachment 2 for details, in the calculations of the Grid emission factor (GEF) of the Luzon-Visayas grid.
Choice of data or Measurement methods and procedures:	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Purpose of data:	Calculation of project emissions
Additional comment:	In case of plants existing before project implementation, the lowest CO_2 emission factor should be used in case of multi fuel plants

B.6.3. Ex ante calculation of emission reductions

The project mainly reduces CO_2 emissions from the displacement of grid power by generation of electricity from biomass residues and from the avoidance of burning cane trash. As described in section B.6.1, the emission reduction calculations are as follows:

Emission Reductions

$ER_y = BE_y - PE_y - LE_y$
(Equation 1 of ACM0018, version 02.0.0)

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

Summary of Emission Reductions

Summary of Calculations of Emission Reductions (ER)

Baseline Emissions (BE)

The **Baseline Emissions (BE)** will come from 2 sources using **ACM0018 version 02.0.0**:

BE Source 1: $\mathbf{BE_{EL,y}}$ = Emissions avoided from grid electricity (tCO_2)

BE Source 2: $\mathbf{BE_{BR,B1/B3,y}}$ = Baseline emissions due to uncontrolled burning of sugar cane trash (Note: only sugar cane trash is burned in the baseline scenario) in year *y* (tCO_2)

Project Emissions (PE)

The Project Emissions (PE) will come from 2 sources:

PE Source 1: $PE_{TR,y}$ = project emissions due to transport of the biomass to the project site

PE Source 2: $PE_{BR,y}$ = project emissions from the combustion of biomass residue (sugar cane trash only) during the year y (tCO_2e)

Baseline Emissions:

Determination of $BE_{EL,y}$

$BE_{EL,y} = EG_{PJ,y} \times EF_{BL,EL,y}$ (3)

Where:

$EG_{PJ,y}$ = 16.11 MW x 7,884 hrs = 127,011.24 MWh

and $EF_{BL,EL,y}$ = 0.494 t CO_2/MWh[53]

$BE_{EL,y}$ = (127,011.24 MWh) x (0.494 tons CO_2/MWh)

$BE_{EL,y}$ = 62,744 tons CO_2 per year (Note: this is a rounded off figure)

Determination of $BE_{BR,B1/B3,y}$

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot NCV_{n,y} \cdot EF_{BR,n,y}$$

(Equation 26 of ACM0018, version 02.0.0)

Where:

$BE_{BR,B1/B3,y}$	*Baseline emissions due to uncontrolled burning of biomass residues (sugar cane trash only) in year y (tCO_2)*
GWP_{CH4}	*Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4) = 21 tCO_2/tCH_4*
$BR_{n,B1/B3,y}$	*Amount of biomass residues category n used in the project plant(s) included in the project boundary in year y for which B3 has been identified as the most plausible baseline scenario (tonnes on dry-basis)*
$NCV_{n,y}$	*Net calorific value of the biomass residues category n in year y (GJ/tonnes on dry-basis)*
$EF_{BR,n,y}$	*CH_4 emission factor for uncontrolled burning of the biomass residues category n during the year y (tCH_4/GJ)*
n	*Categories of biomass residues*

Based on page 35 of ACM0018 version 02.0.0, the default value for the product of $NCV_{n,y}$ and $EF_{BR,n,y}$ is 0.001971 tCH_4/t biomass .

Using the following values to the equation 26, for year 1:

[53] Detailed calculation is found in Annex 3

GWP_{CH4} = 21 tCO_2/tCH_4

$BR_{n,B1/B3,y}$ = 80,217 tonnes

$NCV_{n,y} \bullet EF_{BR,n,y}$ = 0.001971 tCH_4/t biomass (sugar cane trash)

$BE_{BR,B1/B3,1} = GWP_{CH4} \bullet \sum BR_{n,B1/B3,y} \bullet NCV_{n,y} \bullet EF_{BR,n,y}$ **(26)**

= (21) (80,217) (0.001971)

$BE_{BR,B1/B3,1}$ = 3,320 tCO_2 for year 1

Substituting the value of **$BE_{BR,B1/B3,1}$ = 3,320 tCO_2** to the equation:

$BE_{BR,1} = BE_{BR,B1/B3,1} + BE_{BR,B2,1}$

$BE_{BR,1}$ = 3,320 + 0

$BE_{BR,1}$ = 3,320 tCO_2 for year 1

$BE_1 = BE_{EL,1} + BE_{BR,1}$

BE_1 = 62,744 + 3,320

BE_1 = 66,064 tCO_2 for year 1

Using the pertinent parameters for years 1 to 7 and substituting to the above Equations, the following is a summary of the calculations for Baseline Emissions (BE):

Parameter	Unit	Label and Formula	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total for 7 years crediting period
BE Source 1: $BE_{EL,y}$ = Emissions avoided from grid electricity										
$EG_{PJ,y}$	MWh	A	127,011	127,011	127,011	127,011	127,011	127,011	127,011	
$EF_{BL,EL,y}$	tCO_2/ MWh	B	0.494	0.494	0.494	0.494	0.494	0.494	0.494	
$BE_{EL,y}$	tCO_2	C = A * B	62,744	62,744	62,744	62,744	62,744	62,744	62,744	439,205
BE Source 2: $BE_{BR,B1/B3,y}$ = Uncontrolled burning of cane trash										
GWP_{CH4}	tCO_2/ tCH_4	D	21	21	21	21	21	21	21	
$BR_{n,B1/B3,y}$	tonnes sugar cane trash on dry basis	E	80,217	80,217	83,426	96,261	96,261	96,261	96,261	
$NCV_{n,y}$ * $EF_{BR,n,y}$	tCH_4/ tonne biomass on dry-basis	F	0.001971	0.001971	0.001971	0.001971	0.001971	0.001971	0.001971	
$BE_{BR,B1/B3,y}$		G = D * E * F	3,320	3,320	3,453	3,984	3,984	3,984	3,984	26,031
BEy		C + G	66,064	66,064	66,197	66,728	66,728	66,728	66,728	465,236

66,462

Average

<u>Project emissions</u>

From section B.6.1, project emissions:

$\mathbf{PE_y = PE_{TR,y} + PE_{BR,y}}$

The **Project Emissions (PE)** will come from 2 sources:
PE Source 1: $PE_{TR,y}$ = project emissions due to transport of the biomass residue to the project site
PE Source 2: $PE_{BR,y}$ = project emissions from the combustion of biomass residue (sugar cane trash only) during the year y (tCO_2e)

Determination of $PE_{TR,y}$

Using Equation 1 of the tool *"Project and leakage emissions from road transportation of freight":*

$$\left.\begin{matrix} PE_{TR,m} \\ LE_{TR,m} \end{matrix}\right\} = \sum_f D_{f,m} \cdot FR_{f,m} \cdot EF_{CO2,f} \cdot 10^{-6}$$

(Equation 1 of the tool "Project and leakage emissions from road transportation of freight")

Where:

$PE_{TR,m}$	*Project emissions from road transportation of freight monitoring period m (t CO_2)*
$LE_{TR,m}$	*Leakage emissions from road transportation of freight monitoring period m (t CO_2)*
$D_{f,m}$	*Return trip road 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 CO_2 / t km)*
f	*Freight transportation activities conducted in the project activity in monitoring period m*

For a heavy truck (emission factor = 0.000129 tCO_2/t*km), which transports 84,439 tons of cane trash in the first year, with each round trip covering a distance of 60 km, the transport emission is calculated as follows:

PE_{TR} = (84,439 ton) x (80 km) x (0.000129 tCO_2/ton x km) = 871 tCO_2 (cane trash) for year 1

Table 4 shows a Summary of the Project Emissions (PE) due to Transport of the biomass residues to the project plant for every type of biomass. Details of these calculations are in Attachment 1, sub-folder "Summary Formula."

Table 4: Summary of Project Emission (PE) due to Transport of biomass to the Project plant

Activity #	Freight Type	Weight (tons)							Origin & Destination	Roundtrip Distance (km)	Vehicle Class	Emission factor (tCO_2/ t*km)	CO2 Emissions (tCO_2)						
		Y1	Y2	Y3	Y4	Y5	Y6	Y7					Y1	Y2	Y3	Y4	Y5	Y6	Y7
1	Cane trash	84,439	84,439	87,817	101,327	101,327	101,327	101,327	collection site --> plant --> collection site	80	Heavy	0.000129	871.4151	871.4151	906.2717	1045.698	1045.698	1045.698	1045.698
2	Woody ECP	0	0	8,074	8,074	8,939	17,878	17,878	collection site --> plant --> collection site	40	Heavy	0.000129	0	0	41.66404	41.66404	46.12649	92.25299	92.25299
3	Grassy ECP	6,061	12,122	24,243	36,365	48,487	79,225	79,225	collection site --> plant --> collection site	40	Heavy	0.000129	31.27402	62.54804	125.0961	187.6441	250.1922	408.8008	408.8008
4	Woody residues	82,763	62,577	38,354	29,414	0	0	0	collection site --> plant --> collection site	80	Heavy	0.000129	854.1127	645.7926	395.8083	303.5554	0	0	0
5	Other biomass	9,613	9,613	9,613	9,613	9,613	9,613	9,613	collection site --> plant --> collection site	60	Heavy	0.000129	74.40505	74.40505	74.40505	74.40505	74.40505	74.40505	74.40505
													1831.207	1654.161	1543.245	1652.967	1416.422	1621.157	1621.157

Determination of $PE_{BR,y}$

Using Equation 28, ACM0018 version 02.0.0,

$PE_{BR,y} = GWP_{CH4} * EF_{CH4,BR} \sum BR_{PJ,n,y} * NCV_{n,y}$

Where:

$PE_{BR,y}$	*Emissions from the combustion of biomass residues during the year y (tCO_2)*
GWP_{CH4}	*Global Warming Potential for methane valid for the relevant commitment period (tCO_2/tCH_4) = 21 tCO_2/tCH_4*
$EF_{CH4,BR}$	*CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ) = 0.04110 tCH_4/TJ*
$BR_{PJ,n,y}$	*Quantity of biomass residues of category n used in power plants which are located at the project site and included in the project boundary in year y (tonnes on dry-basis/yr) = 80,217 tons/year*
$NCV_{n,y}$	*Net calorific value of the biomass residues category n in year y (GJ/tonnes on dry-basis) = 0.00973 TJ/ton*

Substituting the values in Eq. 28, for year 1, cane trash:

$PE_{BR,y} = GWP_{CH4} * EF_{CH4,BR} \sum BR_{PJ,n,y} * NCV_{n,y}$

= (21 tCO_2/tCH_4) * (.04110 tCH_4/TJ) * (80,217 tons biomass) * (0.00973 TJ/ton biomass residues)

$PE_{BR,y}$ = 674 tCO_2 for year 1

Table 5 shows a Summary of the Project Emissions (PE) due to combustion of biomass residues. Details of these calculations are in Attachment 1, sub-folder "Summary Formula." Table 6, on the other hand, presents a summary of total Project Emissions.

Table 5. Summary of Project Emission (PE) due to Combustion of biomass residues

Parameter	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total for the 7-year crediting period
$BR_{,PJ,n,y}$	tones	80,217	80,217	83,426	96,261	96,261	96,261	96,261	
GWP_{CH4}	$tC0_2/tCH_4$	21	21	21	21	21	21	21	
$NCV_{n,y}$	TJ/ton	0.00973	0.00973	0.00973	0.00973	0.00973	0.00973	0.00973	
$EF_{CH4,BR}$	tCH_4/TJ	0.0411	0.0411	0.0411	0.0411	0.0411	0.0411	0.0411	
$PE_{BR,y}$	**tCO_2**	**674**	**674**	**701**	**808**	**808**	**808**	**808**	**5,282**

Table 6. Summary of Project Emissions (PE)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total for the 7-yr crediting period
$PE_{TR,y}$	tCO_2	1,831	1,654	1,543	1,653	1,416	1,621	1,621	
$PE_{BR,y}$	tCO_2	674	674	701	808	808	808	808	
PE_y	tCO_2	2,505	2,328	2,244	2,461	2,225	2,430	2,430	16,622

Average PE_y
2,375

Leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity. Changes in carbon stocks in the LULUCF sector are expected to be insignificant since this methodology is limited to biomass residues, as defined in the applicability conditions above. The baseline scenarios for biomass residues for which this potential leakage is relevant are B5, B6, B7, and B8. Since B3 is the baseline scenario, Leakage is therefore zero (0).

Substituting the values for year 1 to Equation:

$ER_1 = BE_1 – PE_1 – Leakage_1$:

BE_1 = 66,064 tons CO_2 (refer to Attachment 1 and Section B.6.3 of this PDD)

PE_1 = 2,505 tCO_2

ER_1 = 66,064 – 2,505 – 0

ER_1 = 63,559 tCO_2 for year 1 (Note: This is a rounded off figure)

Detailed computations for years 1 to 7 are in Attachment 1. Below is a summary:

Table 7: Summary of Computations of Emission Reductions (ER) for 7 years

	1	2	3	4	5	6	7	TOTAL	Average
BE_y	66,064	66,064	66,197	66,728	66,728	66,728	66,728	465,236	66,462
PE_y	2,505	2,328	2,244	2,461	2,225	2,430	2,430	16,622	2,375
ER_y	**63,559**	**63,736**	**63,953**	**64,267**	**64,503**	**64,298**	**64,298**	**448,614**	**64,088**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
2015	66,064	2,505	0	63,559
2016	66,064	2,328	0	63,736
2017	66,197	2,244	0	63,953
2018	66,728	2,461	0	64,267
2019	66,728	2,225	0	64,503
2020	66,728	2,430	0	64,298
2021	66,728	2,430	0	64,298
Total (tonnes of CO_2e)	465,236	16,622	0	448,614
Total number of crediting years	7			
Annual average over the crediting period	66,462	2,375	0	64,088

B.7. Monitoring plan

The following sections shall provide a detailed description of the application of the monitoring methodology and a description of the monitoring plan, including an identification of the data to be monitored and the procedures that will be applied during monitoring.

The data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.7.1. Data and parameters to be monitored

Data / Parameter:	Biomass residues categories and quantities used in the project activity
Data unit:	Date for each Type: •Source: obtained from an identified biomass residues producer, obtained from a biomass residues market •Fate in the absence of the project activity (Scenario B3) •Use in the project scenario (Scenario P) •Quantity (tonnes on dry-basis)
Description:	Explain and document transparently in the CDM-PDD, using a table similar to Table 1, which quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their baseline scenario. The last column of Table 1 corresponds to the quantity of each category of biomass residues (tonnes on dry-basis). These quantities should be updated every year of the crediting period as part of the monitoring plan so as to reflect the actual use of biomass residues in the project scenario. These updated values should be used for emissions reductions calculations. Along the crediting period, new categories of biomass residues (i.e. new types, new sources, with different fate) can be used in the project activity. In this case, a new line should be added to the table. If those new categories are of the type B1:, B2: or B3:, the baseline scenario for those types of biomass residues

	should be assessed using the procedures outlined in the guidance provided in the procedure for the selection of the baseline scenario and demonstration of additionality
Source of data to be used:	On-site measurements
Value(s) applied:	•Source :obtained from an identified biomass residues producer, obtained from a biomass residues market •Fate in the absence of the project activity (Scenario B3) •Use in the project scenario (Scenario P) •Quantity (tonnes on dry-basis)
Measurement procedures (if any)	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	* The volume of each truck delivery will be measured. Also, the MC of each delivery will be measured either with a hand-held Moisture Meter or lab procedure and a record of the volume and MC of each truck delivery will be maintained. Based on the volume and MC the quantity of dry biomass will be computed at a pre-determined load density of each category of biomass. 35-footer "truck" attached to it is a 20-footer trailer = 120m^3

Data / Parameter:	$BR_{PJ,n,y}$
Data unit:	tonnes on dry-basis
Description:	Quantity of biomass residues of category n used in power plants which are located at the project site and included in the project boundary in year *y*
Source of data:	On-site measurements
Value(s) applied:	**BE1 -Biomass Fuel Mix at the Boiler-in-Take (BIT) Quantity** (see table below) The table is only for year 1. For years 1 to 7, please refer to Attachment 1.
Measurement procedures (if any)	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	The biomass residue quantities used should be monitored separately for (a) each type of biomass residue (e.g.) and each source (e.g. produced on-site,

BE1 -Biomass Fuel Mix at the Boiler-in-Take (BIT) Quantity

Type of Biomass Fuel	Y1
Sugar Cane Trash	80,217
Woody Energy Crop Plantations (ECP)	-
Grassy Energy Crop Plantations (ECP)	3,100
Woody residues/thinnings from Current Tree Stands (CTS)	56,550
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	6,088
TOTAL	145,956

	obtained from biomass residues suppliers, obtained from a biomass residues market, obtained from an identified biomass residues producer, etc.)

Data / Parameter:	$BR_{n,B1/B3,y}$
Data unit:	tonnes on dry-basis
Description:	Amount of biomass residues category n used in the project plant(s) included in the project boundary in year *y* for which B1 or B3 has been identified as the most plausible baseline scenario
Source of data:	On-site measurements
Value(s) applied	**Quantity of Biomass Transported (Delivered Quantity)** (see table below) For Years 1 to 7, please refer to Attachment 1.
Measurement procedures (if any)	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Quantity of Biomass Transported (Delivered Quantity)

Type of Biomass Fuel	Y1
Cane Trash	84,439
Woody Energy Crop Plantations (ECP)	-
Grassy Energy Crop Plantations (ECP)	6,061
Woody residues/thinning	82,763
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	9,613
TOTAL	182,876

Data / Parameter:	For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario
Data unit:	Tonnes
Description:	Quantity of available biomass residues of type n in the region Quantity of biomass residues of type n that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region Availability of a surplus of biomass residues type n (which cannot be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region
Source of data:	Surveys or statistics
Value(s) applied:	-
Measurement procedures (if any)	-
Monitoring frequency:	At the validation stage for biomass residues categories identified *ex-ante*, and always (monitoring frequency) for new biomass residues categories which are included during the crediting period
QA/QC procedures:	-
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	$BR_{TR,y}$
Data unit:	tonnes on dry-basis
Description:	Quantity of biomass residues that has been transported to the project site during the year *y*
Source of data:	On-site measurements
Value(s) applied:	**Quantity of Biomass Transported (Delivered Quantity)** (see table below)
Measurement procedures (if any)	Use weight or volume meters. If volume meters are used convert to mass units using the density of each category of biomass residues. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Quantity of Biomass Transported (Delivered Quantity)

Type of Biomass Fuel	Y1
Cane Trash	84,439
Woody Energy Crop Plantations (ECP)	-
Grassy Energy Crop Plantations (ECP)	6,061
Woody residues/thinning	82,763
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	9,613
TOTAL	182,876

Data / Parameter:	$EG_{PJ,gross,y}$
Data unit:	MWh
Description:	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y*
Source of data:	
Value(s) applied:	18 MW * (7,884 hrs) = 141,912 MWh
Measurement procedures (if any)	On-site measurements
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years)
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	$EG_{PJ,aux,y}$
Data unit:	MWh
Description:	Total auxiliary electricity consumption required for the operation of the power plants at the project site
Source of data:	On-site measurements
Value(s) applied:	141,912 MWh * .105 (10.5% for plant use) = 14,900.76 MWh
Measurement procedures (if any)	Use calibrated electricity meters
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate

	emissions reductions
QA/QC procedures:	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years)
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	$EG_{PJ,aux,y}$ shall include all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power plants which are located at the project site and included in the project boundary (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.)

Data / Parameter:	$NCV_{n,y}$
Data unit:	TJ/tonnes on dry-basis
Description:	Net calorific value of biomass residues of category n in year *y*
Source of data:	On-site measurements
Value(s) applied:	**Net Calorific Value of Biomass Residues** Type of Biomass Fuel — NCV Cane Trash — 0.00973 Woody Energy Crop Plantations (ECP) — 0.01187 Grassy Energy Crop Plantations (ECP) — 0.01007 Woody residues/thinning — 0.01187 Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo) — 0.01282
Measurement procedures (if any)	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure the NCV on dry-basis
Monitoring frequency:	At least every six months, taking at least three samples for each measurement
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	$EF_{BR,n,y}$
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for uncontrolled burning of the biomass residues category *n* during the year *y*
Source of data:	Conduct measurements or use reference default values
Value(s) applied:	.001971 tCH_4/ton biomass– product of NCV and EF, default value in the Methodology, page 36.
Measurement procedures (if any)	To determine the CH_4 emission factor, project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of

	biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$
Monitoring frequency:	-
QA/QC procedures:	-
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	AVD_y
Data unit:	km
Description:	Average round trip distance (from and to) between biomass fuel supply sites and the project site
Source of data:	Records by project participants on the origin of the biomass
Value(s) applied:	see table below
Measurement procedures (if any)	-
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	Applicable if option 1 is chosen to estimate CO_2 emissions from transportation. If biomass is supplied from different sites, this parameter should correspond to the mean value of km traveled by trucks that supply the biomass plant

Value(s) applied:

Type of Biomass Fuel	AVD_y - Round trip distance (km)
Cane Trash	80
Woody Energy Crop Plantations (ECP)	40
Grassy Energy Crop Plantations (ECP)	40
Woody residues/thinning	80
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	60

Data / Parameter:	$EF_{km,y}$
Data unit:	tCO_2/km
Description:	Average CO_2 emission factor for the trucks during the year *y*
Source of data:	Conduct sample measurements of the fuel type, fuel consumption and distance traveled for all truck types. Calculate CO_2 emissions from fuel consumption by multiplying with appropriate net calorific values and CO_2 emission factors. For net calorific values and CO_2 emission factors, use reliable national default values or, if not available, (country-specific) IPCC default values. Alternatively, choose emission factors applicable for the truck types used from the literature in a conservative manner (i.e. the higher end within a plausible range)
Value(s) applied:	.00089216
Measurement procedures (if any)	-

Monitoring frequency:	At least annually
QA/QC procedures:	Cross-check measurement results with emission factors referred to in the literature
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	TL_y
Data unit:	Tonnes
Description:	Average load of the trucks used for transportation of biomass
Source of data:	On-site measurements
Value(s) applied:	see table below
Measurement procedures (if any)	Determined by averaging the weights of each truck carrying biomass to the project plant
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	-
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Type of Biomass Fuel	TL_y - Truck Capacity (ton)
Cane Trash	15
Woody Energy Crop Plantations (ECP)	20
Grassy Energy Crop Plantations (ECP)	15
Woody residues/thinning	20
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	15

Data / Parameter:	$EF_{FF,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor fuel type *i* in year *y*
Source of data:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default emission factors (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the value in a conservative manner and justify the choice
Value(s) applied:	74.10
Measurement procedures (if any)	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Monitoring frequency:	In case of measurements: At least every six months, taking at least three samples for each measurement In case of other data sources: Review the appropriateness of the data annually
QA/QC procedures:	Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Purpose of data:	For calculating expected emission reductions in section B.5

Additional comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value of the fossil fuel type *i* in year *y*
Source of data:	Either conduct measurements or use accurate and reliable local or national data where available. Where such data is not available, use IPCC default net calorific values (country-specific, if available) if they are deemed to reasonably represent local circumstances. Choose the values in a conservative manner and justify the choice
Value(s) applied:	43
Measurement procedures (if any)	Measurements shall be carried out at reputed laboratories and according to relevant international standards
Monitoring frequency:	In case of measurements: At least every six months, taking at least three samples for each measurement In case of other data sources: Review the appropriateness of the data annually
QA/QC procedures:	Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	-

Data / Parameter:	$EF_{CH4,BF}$
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for the combustion of biomass residues in the project plant
Source of data:	On-site measurements or default values
Value(s) applied:	.001971 tCH_4/ton
Measurement procedures (if any)	The CH_4 emission factor may be determined based on a stack gas analysis using calibrated analyzers
Monitoring frequency:	At least quarterly, taking at least three samples per measurement
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
Purpose of data:	For calculating expected emission reductions in section B.5
Additional comment:	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Note that a conservative factor shall be applied, as specified in the baseline methodology

Data / Parameter:	Consumption of Lignite as start-up/back-up fuel
Data unit:	Tons
Description:	Tons of lignite consumed as start-up/back-up fuel
Source of data:	On-site measurements
Value(s) applied:	To be monitored ex post
Measurement procedures (if any)	By weight meter
Monitoring frequency:	To be monitored on “as need” basis
QA/QC procedures:	Weight meter to be calibrated when needed
Purpose of data:	For calculating emission reductions in section B.5
Additional comment:	--

B.7.2. Sampling plan

1. Parameter to be sampled	Availability of biomass residues
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the availability each type of biomass residues during the crediting period, with a 95/10 level of confidence/precision. **a.2) Target Population:** 1) Available biomass residues of type *n* in the region, and 2) Existing utilization of biomass residues of type *n* (e.g. for energy generation or as feedstock) in the defined geographical region **a.3) Sampling Method:** Surveying shall be performed, where stratified sampling shall be used for each type of biomass residues [a. sugar cane trash, b. woody residues/thinning, c. biomass from woody energy crop plantation, d. biomass from grassy energy crop plantation, and e. other biomass residues (coconut, rice husks/straw, corn cobs)]. **a.4) Sample Size:** For each type of biomass residues, 100 data sets shall be taken, which is the recommended sample size for large population at a confidence interval of 95% and precision level of 10%. **a.5) Sampling Frame:** Biomass sources as well as existing utilization of each biomass type.

B. Data	**b.1) Field Measurements:** Use of surveys which would include an inventory listing of biomass sources as well as existing utilization of each biomass type shall be prepared. **b.2) Quality Assurance/Quality Control:** Results will be cross-checked with agricultural statistics from the government, if available. **b.3) Analysis:** The difference between the a) Quantity of available biomass residues of type *n* in the region, and b) Quantity of biomass residues of type *n* that are utilized, will be interpreted as a surplus which is available for the operation of the project.
C. Implementation	**c.1) Implementation Plan:** Survey to be conducted before the start of the project.

2. Parameter to be sampled	$BR_{TR,y}$ Quantity of biomass residues transported to the project site during the year y
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the annual value of the Quantity of biomass residues transported to the project site during the year y, with a 95/10 level of confidence/precision. **a.2) Target Population:** Inventory of available biomass residues for a given year. **a.3) Sampling Method:** Stratified sampling shall be used for each type of biomass residues [a. sugar cane trash, b. woody residues/thinning, c. biomass from woody energy crop plantation, d. biomass from grassy energy crop plantation, and e. other biomass residues (coconut, rice husks/straw, corn cobs)]. **a.4) Sample Size:** For each type of biomass residues, all of the the daily transport data shall be used, equivalent to the number of days in a given year the plant is operational. **a.5) Sampling Frame:** An inventory listing of biomass sources. The biomass residue quantities will be listed separately for each type of biomass residue and each source (e.g. produced on-site, obtained from biomass residues suppliers, obtained from a biomass residues market, obtained from an identified biomass residues producer, etc.)
B. Data	**b.1) Field Measurements:** The volume of each truck delivery will be measured. Data will be adjusted for moisture content in order to determine the quantity of dry biomass. **b.2) Quality Assurance/Quality Control:** Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes

	b.3) Analysis: Based on the volume and moisture content, the quantity of dry biomass will be computed at a pre-determined load density of each category of biomass.
C. Implementation	**c.1) Implementation Plan:** The volume of each truck delivery will be measured. Also, the moisture content of each delivery will be measured either with a hand-held Moisture Meter or lab procedure. A record of the volume and moisture of each truck delivery will be maintained. Attached to a 35-footer "truck" is a 20-footer trailer with a volume of 120 m^3.

3. Parameter to be sampled	$NCV_{n,y}$ Net calorific value of biomass residues of category *n* in year y
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the Net calorific value of biomass residues of category *n* in year y, with a 95/10 level of confidence/precision. **a.2) Target Population:** Biomass residues category *n* used in the project plant(s) included in the project boundary in year y, for which B1 or B3 has been identified as the most plausible baseline scenario. **a.3) Sampling Method:** Stratified sampling shall be used for each type of biomass residues [a. sugar cane trash, b. woody residues/thinning, c. biomass from woody energy crop plantation, d. biomass from grassy energy crop plantation, and e. other biomass residues (coconut, rice husks/straw, corn cobs)]. **a.4) Sample Size:** At least every six months, taking at least three samples for each measurement. **a.5) Sampling Frame:** An inventory listing for each type of biomass residue.
B. Data	**b.1) Field Measurements:** Measurements shall be carried out at reputed laboratories. **b.2) Quality Assurance/Quality Control:** Measurements shall be done according to relevant international standards. Measurements shall be compared with those from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements shall be conducted. **b.3) Analysis:** Based on the moisture content, the NCV will be computed on a dry basis.
C. Implementation	**c.1) Implementation Plan:** Monitoring shall be made at least every six months.

4. Parameter to be sampled	AVD_y Average round trip distance (from and to) between biomass fuel supply sites and the project site
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the Average round trip distance (from and to) between biomass fuel supply sites and the project site, with a 95/10 level of confidence/precision. **a.2) Target Population:** Round trip distance (from and to) between biomass fuel supply sites and the project site for the whole year. **a.3) Sampling Method:** Stratified sampling shall be used for the transportations of each type of biomass residues [a. sugar cane trash, b. woody residues/thinning, c. biomass from woody energy crop plantation, d. biomass from grassy energy crop plantation, and e. other biomass residues (coconut, rice husks/straw, corn cobs)]. **a.4) Sample Size:** For trucks transporting each type of biomass residues, 80 samples shall be taken, which is the recommended sample size for population of 375, at a confidence interval of 95% and precision level of 10%. **a.5) Sampling Frame:** An inventory listing of distance travelled of each transporting vehicle for each type of biomass.
B. Data	**b.1) Field Measurements:** Daily vehicle kilometer travelled (VKT) of each transporting vehicle for each type of biomass will be recorded. **b.2) Quality Assurance/Quality Control:** Vehicle kilometer travelled shall be cross-checked with fuel consumption data. **b.3) Analysis:** No further data analysis shall be done, since it will be used directly in the calculation of emissions reduction.
C. Implementation	**c.1) Implementation Plan:** Recording shall be kept by the person in charge of the vehicle.

5. Parameter to be sampled	TL_y Average load of the trucks used for transportation of biomass
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the Average load of the trucks used for transportation of biomass, with a 95/10 level of confidence/precision.

	a.2) Target Population: Truck loads in all trips made by each truck which transports biomass residues of category *n*. **a.3) Sampling Method:** Stratified sampling shall be used for the transportations of each type of biomass residues [a. sugar cane trash, b. woody residues/thinning, c. biomass from woody energy crop plantation, d. biomass from grassy energy crop plantation, and e. other biomass residues (coconut, rice husks/straw, corn cobs)]. **a.4) Sample Size:** For trucks transporting each type of biomass residues, 80 samples shall be taken, which is the recommended sample size for population of 375, at a confidence interval of 95% and precision level of 10%. **a.5) Sampling Frame:** An inventory listing of truck load of each transporting vehicle for each type of biomass.
B. Data	**b.1) Field Measurements:** For every transport, weight of truck load according to the type of biomass will be recorded. **b.2) Quality Assurance/Quality Control:** Truck load data shall be cross-checked with annual inventory. **b.3) Analysis:** No further data analysis shall be done, since it will be used directly in the calculation of emissions reduction.
C. Implementation	**c.1) Implementation Plan:** Recording shall be kept by the person in charge of the vehicle.

6. Parameter to be sampled	$EF_{CH_4,BR}$ CH_4 emission factor for the combustion of biomass residues in the project plant
A. Sampling Design	**a.1) Objectives and Reliability Requirements:** To determine the CH4 emission factor for the combustion of biomass residues in the project plant, with a 95/10 level of confidence/precision. **a.2) Target Population:** Biomass residues category *n* used in the project plant in year y, for which B1 or B3 has been identified as the most plausible baseline scenario. **a.3) Sampling Method:** The CH_4 emission factor may be determined based on a stack gas analysis using calibrated analyzers. **a.4) Sample Size:** At least quarterly, taking at least three samples per measurement. **a.5) Sampling Frame:** The inventory of biomass residues used in the project plant.

B. Data	**b.1) Field Measurements:** Measurements shall be carried out at reputed laboratories. **b.2) Quality Assurance/Quality Control:** Measurements shall be done according to relevant international standards. Measurements shall be compared with those from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements shall be conducted. **b.3) Analysis:** No further data analysis shall be done, since it will be used directly in the calculation of emissions reduction.
C. Implementation	**c.1) Implementation Plan:** Measurement shall be made at least every six months. Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary.

B.7.3. Other elements of monitoring plan

The monitoring plan is a guide to monitor the emission reduction of the proposed project.

The Monitoring Plan is composed of:

The CDM monitoring team

A CDM monitoring team will be formed for the CDM project composed of personnel to make sure that the CDM methodology is followed in monitoring all the data stated under “Data to be Monitored” to make sure that the project is in compliance with the CDM monitoring and verification requirements.

The **Plant General Manager (GM)** will be in charge of approving the monitoring report. The CDM manager and the relevant monitoring team members will be responsible for the data management and recording and monitoring report. The Plant General Manager manages the CDM manager, Data Collection Team and the Financing and Data Filing Manager. The Plant General Manager will lead the organization and report directly to SCBP’s COO. Supporting the Plant General Manager will be a CDM Manager, a Data Collection Team and the Financing and Data Filing Manager.

The **CDM Manager** will organize the CDM training, present all the procedure and methodology related to the monitoring of the project, correcting any errors in time and acting as the quality supervisor of the monitoring process.

The **Data Collection Team** will be responsible for the monitoring associated with biomass collection, the transportation emissions, the mechanical biomass pretreatment emissions and assisting the annual leakage analysis. This Team includes the Fuel Supply Division which will primarily engage in two operations:

- Logistics – to own, maintain and operate a fleet of equipment and personnel to gather, collect, receive, process, store and transport fuel from various sources to the plant site.

- Energy Crop Plantations – to establish, maintain and operate plantations as dedicated and sustainable sources of biomass fuel for the power plant.

Supporting the Division Manager of the Data Collection Team will be a Logistics Department Manager, an Energy Crop Plantation (ECP) Department Manager and an Administrative Manager. The project's strategy is to provide the Division with all the necessary resources that may be required to source and supply the fuel, including a large fleet of trucks, farm collection equipment and as many as 150 personnel.

The **Financing & Data filing Manager** will prepare the available original invoices or receipts associated with the whole monitoring process. They will collect the relevant data from the Operations and the Data Collection Team, summarize the data, file the data and submit reports to the CDM manager in time.

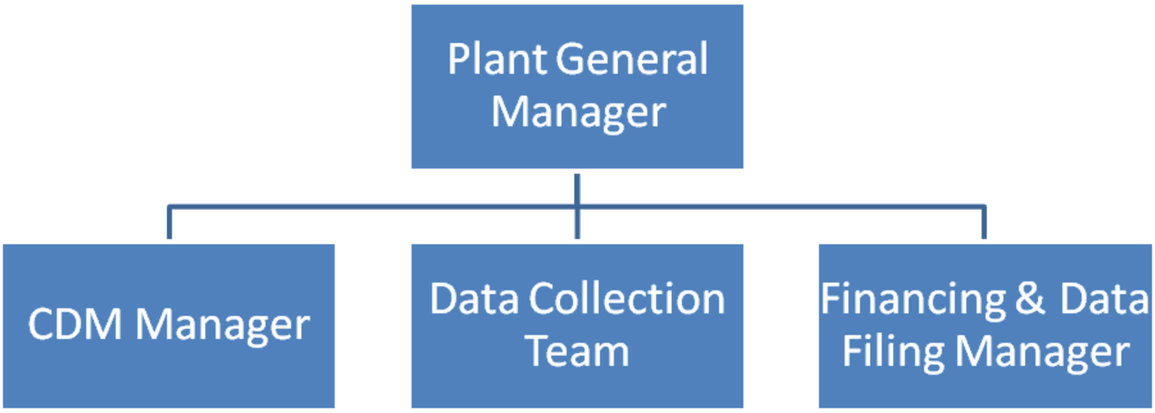

Figure 6. CDM Monitoring Team

Export power will be recorded by a calibrated meter. Should the meter fail, the net power export can be calculated from the difference between the gross generation recorded by the meter at the generator and the auxiliary meter.

The metered electricity generation should be cross-checked with receipts from electricity sales and the quantity of fuels fired (check whether the actual electricity generation divided by the quantity of fuels fired will result in a reasonable efficiency, and check if it is comparable to previous years).
A factor based on historical data will be used, that is, electricity generation per day multiplied by the number of days, will determine the amount of electricity for a certain period.

The calculation will be based on the quantity of biomass residues processed in tonnes and the electricity consumption factor (kWh/tonne).

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity

10/08/2012 – Awarding of EPC Contract Agreement for SCBP Power Plant between SCBP and Wuxi Huaguang Electric Power Engineering Co., Ltd

C.1.2. Expected operational lifetime of project activity

20 years, 0 months

C.2. Crediting period of project activity
C.2.1. Type of crediting period

Renewable crediting period

C.2.2. Start date of crediting period

01/01/2015

C.2.3. Length of crediting period

7 years, 0 month - for the first crediting period

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts

An Environmental Compliance Certificate (ECC) was issued on 19 February 2010 for a 15 MW capacity, Reference Code ECC R6 0912 393 4220. Amended 28 June 2011 to upgrade the capacity from 15 to 18 MW.

A. Fuel and Air Emissions

The selection of the boiler optimizes emission control measures given the varying oxide levels, sulfur, heating values and ash present in the different types of biomass utilized by the Plant. The boiler selected is designed for high-alkali biomass and low ash fusion temperatures.

The boiler minimizes fouling and slagging of the superheaters and also lowers emission levels. The particulate matter emission levels comply with the DENR standards as well as World Bank standards for biomass fuel.

The low level of particulate matter is attributed to the cyclone dust collectors and bag house filter that will remove dust particles with 99.9% efficiency. There are other features to prevent particulate matter emissions, which include the use of enclosed conveyors; design and operating transport systems to minimize the generation and transport of dust on site; use of an enclosed storage structure for processed fuel that will minimize fugitive dust emissions; and installation of cyclone dust collectors.

The SC Biopower site is not located in a degraded airshed or ecologically sensitive area. The emission levels of the Plant are not expected to contribute a significant portion to ambient air quality in the area and would be below the air quality standard set by DENR as recommended by World Bank guidelines.

B. Water Consumption

The water requirement of the Project will be supplied by San Carlos Land Inc., the water utility of the San Carlos Ecozone and a duly registered corporation that owns and operates the deep wells of the aquifer. These wells are permitted by the National Water Resources Board to supply the Plant. As part of the Project's environmental compliance to the DENR, it will install a cistern and other appropriate technologies and best practices in rainwater collection systems for water conservation measures aside from re-use of water from the reverse osmosis facility.

C. Effluents

Cooling ponds or cooling towers are the primary technologies for re-circulating cooling water systems. SC Biopower intends to maintain the integrity of all bodies of water, avoid endangerment of

environmentally sensitive areas, and will pose no significant risk to human health or the environment due to elevated temperatures or residual levels of water treatment chemicals.

SC Biopower has also carefully considered the drainage route in designing the Plant layout. During construction, the Project is expected to implement DENR environmental management requirements that will include rehabilitation measures in compliance with the Clean Water Act of the Philippines. To comply, SC Biopower has planned for the construction of a temporary drainage canal with silt traps to treat entrained run-off during heavy rains and dewatering of excavations prior to its discharge to any body of water.

D. Solid Wastes

Biomass-fired thermal plants such as SC Biopower generate solid wastes due to the ash content of the fuel. As mentioned in Section 5, SC Biopower will install fly ash and bottom ash collection systems. As ash residues are typically not classified as hazardous wastes due to their inert nature, SC Biopower intends to use this ash as an additive to soil compost as the primary means of disposal.

Solid wastes generated during construction and operation will be properly collected, segregated and disposed—taking into consideration the concept of Ecological Solid Waste Management, particularly the proper management of “Industrial Solid Wastes.”

E. Hazardous Materials and Oil

All hazardous toxic material stored and used at the combustion facility will be disposed of in compliance with The Toxic, Hazardous and Nuclear Waste Control Act. As required by the ECC, these materials shall not be disposed to public dumpsites and shall be properly handled and stored. Used oil generated will be properly handled, stored and disposed as mandated under the provisions of Republic Act 6969.

F. Fuel Sustainability

As discussed, there is more biomass fuel available than what the Project needs in the form of cane field residues. These biomass residues generated in sugarcane farming are commonly left on the field and burned in preparation for the next crop despite a government ban on open burning. The collection of cane field residues for use in bioenergy not only supports the Clean Air Act, but also avoids methane emissions from decaying biomass. Efforts are being undertaken in identifying suitable collection equipment that minimizes soil compaction impacts, optimizes biomass collection, and leaves certain levels of biomass on the ground for natural composting.

D.2. Environmental impact assessment

The project is categorized by the DENR as a Non-Critical Project in a Critical Area. Thus, an Initial Environmental Examination (IEE) Report was prepared. The IEE Report confirms the project design will minimize negative environmental impacts by complying with the Philippine environmental standards and conditions stipulated in the Environmental Compliance Certificate; and the implementation of its Environmental Monitoring Plan.

As per the IIE Report:

a) Air Quality - The impacts on air quality will be generally attributed to the operation of the boiler facility. Combustion gasses and particulate matter generated by the fuel burning process is identified as the major source of air pollution
b) Hydrology and Water Quality - Though minimal, operation of the facility is seen to produce wastewater and other pollutants, such as oil and fuel spills, which, if not properly controlled and mitigated, will eventually affect groundwater and surface water quality in the project vicinity.

c) Topography and Soils - There will be no change in topography and soils in the project site, as the change in topography and soils resulting from the construction stage will be the final grade/elevation of the project site all throughout the operations stage.
d) Noise - Significant noise level increases are anticipated during the projects operation phase. Operation of the boiler facility, fuel handling facility and equipment mobilization are potential sources of noise pollution.
e) Meteorology - Because of the scale of the proposed project, there will be no significant impact on the meteorology of the area.
f) Exhaust Gases - Exhaust gases from the boiler facility, delivery/hauling trucks, and company vehicles are potential sources of exhaust gases. Operating the facility under optimum conditions, requiring the appropriate maintenance and use properly operating equipments will minimize air pollution generation of project operation.
g) Water Supply - There will be an added demand of water supply to the area because of the water requirements of the boiler facility and the cooling system of the power plant.
h) Solid Waste Disposal - Solid waste produced during facility operation is very minimal, since the activities within the power plant will employ a limited number of workers. Generated waste will be integrated to the local garbage collection system of San Carlos City.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

The first public consultation/meeting with the Brgy officials was held on July 3, 2009, as evidenced by the minutes of that meeting as well as the preliminary endorsement documents. Next was the consultation with city officials, held at the City Hall on July 28, 2009. Both were consulted about the project's potential contribution to sustainable development particularly at barangay level that will be likely to be positively impacted by the project development, construction and operations. A presentation was made to key barangay officials who have endorsed the project to the City Councilors . Another project presentation was made to the City Council for their endorsement of the project to DENR-EMB for the ECC. Although the DENR does not require the LGU endorsement for the issuance of the ECC, the City Council has found merits in it and supports the project development where in the ECC is a critical document to further the project's development progress.

Further consultations were done with the barangay residents on July 22, 2011 at Barangay Palampas for the introduction of the project and its contribution to climate change mitigation. The event was co-organized by the project developer and Barangay officials, which was led by the Brgy Captain himself. Letters were distributed to the local line agencies (CENRO), school principals, church leaders; announcements posted in the highly visible areas in the City Hall, Barangay Hall, Public Market and other public places. During the consultation, the event held an open forum wherein the participants, mostly residents of Brgy. Palampas, shared their thoughts and posed their questions. These were carefully tackled and will be taken into consideration during project design development and operations planning.

Another formal consultation was made for the City Council members on their regular session. The project design was presented along with its potential benefits and project updates. The councillors have raised their questions and concerns and were addressed. Issues that were not answered like investment opportunities for local residents were raised to the project's management for further exploration.

All concerns are considered important. They were noted and were considered in the project design.

E.2. Summary of comments received

Name	Address	Question/Comment	Answer
Hipolito Cañete Bgy Kagawad	Bgy. Palampas	Is there smoke from the chimney of the plant	I had also been exposed to exhaust smoke by

		that could harm the people?	sugar centrals and I don't like it. There will be no harmful smoke that would come from the power plant smoke stack. The plant is a modern plant that has facilities to filter particulates and other emissions. It will comply with the emission limits set by the Department of Environment and Natural Resources (DENR) and the World Bank –J. M. Zabaleta
Grace Pacres School teacher	Sitio Mangga	Since the plant is producing electricity Can our school be given electricity and the nearby barangays? We had been sacrificing the lack of electricity in our school and homes?	We do not have the license to distribute electricity. The electric cooperative is the duly authorized provider while SC Biopower is the electricity producer. By law, we will connect to the Grid - J. M. Zabaleta The electric cooperative can install the electricity lines if there are signigicant number of consumers in an area. This is dependent on the return on investment. The local government maybe be able to do that if it has enough funds. Hopefully the revenue from the power plant may give the funds to allow the City to connect you to VMC Rural Electric Service Cooperative Inc. (VRESCO). - Mayor of San Carlos
Mark Cui Bgy Captain	Bgy. Palampas	Will electricity rates lower in our place due to the operation of the plant?	SC Biopower will supply electricity to the grid, therefore the grid decides the rate.

		Will brownouts be avoided?	Yes, hopefully there will be no more brownouts. J. M. Zabaleta
Diosdado Verana Bgy Kagawad	Bgy. Palampas	What jobs would be given to us by the project?	During construction period, the contractors are in-charge of looking for workers. Long-term employment for the local people depends on skills and educational background. Some can work as equipment operators, drivers, biomass harvesters, biomass planters and some of you could gather biomass and sell them to the plant.-J. M. Zabaleta
Aquilino Saavedra Bgy. Kagawad	Bgy Palampas	Last year during our meeting, we agreed that you will be hiring 70% of workers among us and you signed an agreement.	SC Biopower has not made any calls for hiring of workers. SC Bioenergy has made the call for its construction but did not find enough skilled people in the Barangay. For SC Biopower, all able and capable unskilled workers in Barangay Palampas will be welcomed- For unskilled workers 70% will be hired from the locals-no problem.-. For skilled-required jobs, the respective contractors will do the selection depending on the skills required. J. M. Zabaleta Let us look at the long term effect of the plant to our livelihood and work opportunities. The construction is only there for a short period

			of time. To be a construction worker is a temporary job. But the harvesting and planting of biomass is a long term opportunity of gaining income. Housewives and children can gather and harvest biomass to be sold to the plant. - Rogelio Debulgado Former Mayor, San Carlos City
Alex Galvez	Sitio Vasconia	What would happen to the houses where the plant would be installed?	The residents of Hacienda Vasconia are employees of GHI Coop and they will be relocated by GHI in the same manner the people were relocated to Ledesma Heights. Existing houses would be evaluated according to the materials it is made of, concrete or wood and financial assistance will be given to the affected families- Martin Cui (Gamboa Hermanos) All of these is part of the consultation process, everything will be finalized as soon as permits are finished. Then agreements will be made- J. M. Zabaleta
Mark Cui Bgy. Captain	Bgy Palampas	We hope that the buying of biomass will be in a per kilo basis not per ton.	We will find a mechanism that we will be able to buy on a per kilo basis- J. X. Zabaleta
Ben Repitillo		Will the plant use water? Would it affect drinking water in the City	Drinking water in the city will not be affected by the operation of the plant, as the plant will have its own water source. –Waste water will be used as water for irrigation. – J. M.

			Zabaleta
Rev. Fr. Johnny Lagdamen		Would the price of biomass differ depending on the kind?	Yes – JXZabaleta
Ricardo Tilag Sr. Bgy. Kagawad	Bgy. Palampas	We have trees in the upland, how much is per kilo?	The buying price depends on the Feed In Tariff (FIT) which will be announced in September. That is the time when we will be able to know the buying price of biomass. The government, through the ERC decides the FIT –J. M. Zabaleta
Rebecca Albero	Sitio Sta. Ana	The source of biomass is quite far from the plant. Whatever money we get out of the sales of biomass is just enough to pay for the transportation from the source to the plant.	We could send a big truck for your biomass but there should be enough amount of biomass to fill the truck full. This way we maximize fuel use if the trucks are full of biomass. There will be a price of biomass as Picked-up and Delivered. The full mechanism is still to be determined and these inputs are helpful in crafting the most suitable for the situation - J. X. Zabaleta

E.3. Report on consideration of comments received

The stakeholders' questions were answered as described above.

There will be regular consultation with the Barangay Officials, particularly with the Barangay Captain, City Mayor and key City officials, as well as with land lessor for the people who will be relocating to another area.

SECTION F. Approval and authorization

LOA was approved on 5 June 2012 and was amended on 11 June 2012 to reflect the rated capacity of 18 MW instead of 18.9 MW

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Appendix 1: Contact information of project participants

Organization name	San Carlos Biopower Inc.
Street/P.O. Box	Circumferential Road
Building	Barangay Palampas, San Carlos Ecozone
City	San Carlos City
State/Region	Negros Occidental
Postcode	
Country	Philippines
Telephone	+(63) (34) 729 8177
Fax	+(63) (34) 729 8177
E-mail	info@bronzeoakph.com
Website	
Contact person	Juan Xavier P. Zabaleta
Title	President
Salutation	
Last name	Zabaleta
Middle name	
First name	Juan Xavier
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	xzabaleta@gmail.com

Appendix 2: Affirmation regarding public funding

No public funding will be used for this project.

Appendix 3: Applicability of selected methodology

Refer to Section B.2.

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

Details of Calculation of the Grid emission factor

Based on the latest "Tool to calculate the emission factor for an electricity system", Version 03.0.0, the following six steps need to be followed:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the Operating Margin ("**OM**").
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the Combined Margin ("**CM**") emissions factor.

STEP 1. Identify the relevant electricity systems.

The project participant selected the Luzon-Visayas grid, the selection of which is justified below:

There are three grids in the Philippines officially defined by the Philippines' Department of Energy (PDOE) and acknowledged by the Philippines' Department of Environment and Natural Resources (DENR), and the host country Designated National Authority ("DNA"), i.e. Luzon, Visayas and Mindanao[54].

The Project is located in Barangay Palampas, San Carlos Ecozone, San Carlos City, Negros Occidental, Philippines. Considering the interconnection of the Luzon and the Visayas grids, the project participants calculated the emission factor combining the two grids as one. The calculations used in this PDD are based on the latest 2011 net generation data from the Philippine Department of Energy (PDoE), while the CDM-registered Philippine projects have not yet used the 2011 data as of this project's PDD preparation. Furthermore, this Grid Emission Factor (GEF) calculations followed the methodology, by using the net generation, while the others used gross generation. This would explain the difference in the resulting combined margin (CM) grid emission factor as compared to the GEF of the other CDM-registered projects in the Philippines.

The baseline emission factor was calculated as a combined margin (CM), consisting of the combination of the operating margin (OM) and build margin (BM) according to the steps specified under the "Tool to calculate the emission factor for an electricity system", Version 03.0.0.

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

Option 1 is chosen "Only grid power plants are included in the calculation".

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:
(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

[54] Power Sector Situationer 2007. Department of Energy Power Statistics. http//www.doe.com.ph/EP/Powerstat.html

The simple OM method (option a) can only be used if low-cost/must-run resources[55] constitute less than 50% of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. This calculation will use 1) average of the five most recent years. (Please see below, **Table: Net Power Generation of Luzon-Visayas 2007-2011),** which shows that the simple OM can be used, as low-cost/must-run resources constitute less than 50% of total grid generation. It is shown that low-cost/must-run resources is only **26%** of total grid generation.

Dispatch data analysis OM (c), cannot be used since dispatch data are not available to the project participants. Simple adjusted OM (b) is not feasible to calculate because the number of hours per year of operation is not available. The remaining options are simple OM (a) and average OM (d). Simple OM is selected since data are available.

The methodology requires only one of the conditions above. The use of Simple OM method can be justified by: Low cost/must run resources constitute less than 50% of total grid generation (Refer to Table 1). Moreover, coal is not considered as a 'must run' resource. Justification of such is presented in the response to the scope of review through a confirmation letter from PDOE[56].

[55] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

[56] Reference: Philippines CDM Project No. 1967: Anaerobic Digestion Swine Wastewater Treatment With On-Site Power Project (ADSW RP2007) - http://cdm.unfccc.int/Projects/DB/SGS-UKL1217323878.48/view

Table: Net Power Generation of Luzon-Visayas Grid 2007-2011

LUZON	NET GENERATION (MWh)					Total (2007-2011)
	2007	2008	2009	2010	2011	
Coal-fired	13,038,425	12,177,615	12,659,623	18,200,641	17,748,287	73,824,591
Oil-based	1,738,742	1,398,171	1,373,319	2,665,200	642,524	7,817,956
Combined Cycle	*611,322*	*494,200*	*615,650*	*1,141,815*	*119,294*	*2,982,281*
Diesel	*991,771*	*459,292*	*197,243*	*492,243*	*258,260*	*2,398,809*
Gas Turbine	*0*	*0*	*0*	*0*	*0*	*0*
Oil Thermal	*135,649*	*444,679*	*560,425*	*1,031,142*	*264,970*	*2,436,865*
Geothermal	3,393,496	3,523,159	3,288,394	3,116,916	3,246,004	16,567,969
Hydroelectric	4,521,166	5,346,812	5,491,983	3,976,651	4,542,369	23,878,981
Natural Gas	18,427,195	19,190,817	19,490,679	19,137,438	20,193,109	96,439,238
Wind	57,187	60,826	63,908	61,223	87,457	330,601
Biomass			2,382	13,119	40,183	55,684
TOTAL LUZON	**41,176,211**	**41,697,400**	**42,370,288**	**47,171,188**	**46,499,933**	218,915,020

VISAYAS	NET GENERATION (MWh)					Total (2007-2011)
	2007	2008	2009	2010	2011	
Coal-fired	738,845	647,603	727,725	1,366,056	3,710,215	7,190,444
Oil-based	1,396,379	1,569,902	1,747,136	1,602,924	376,240	6,692,581
Combined Cycle	*0*	*0*	*0*	*0*	*0*	*0*
Diesel	*1,266,648*	*1,356,909*	*1,458,047*	*1,347,211*	*376,240*	*5,805,055*
Gas Turbine	*8,971*	*36,179*	*61,417*	*3,085*	*0*	*109,652*
Oil Thermal	*120,760*	*176,814*	*227,672*	*252,628*	*0*	*777,874*
Geothermal	5,355,959	5,798,277	5,623,724	5,382,986	5,239,388	27,400,334
Hydroelectric	29,185	40,028	41,748	35,269	50,054	196,284
Natural Gas	0	0	0	0	0	0
Wind	0	0	0	0	0	0
Biomass			9,533	12,896	30,926	53,355
TOTAL VISAYAS	**7,520,368**	**8,055,810**	**8,149,866**	**8,400,131**	**9,406,823**	41,532,998

Step 4: Calculate the operating margin emission factor according to the selected method
(a) Simple OM

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

Option A will be used, which is based on the net electricity generation and a CO_2 emission factor of each power unit[57].

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

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

[57] Power□□ units should be considered if some of the power units at the site of the power plant are low-cost/must-run units and some are not. Power plants can be considered if all power units at the site of the power plant belong to the group of low-cost/must-run units or if all power units at the site of the power plant do not belong to the group of low-cost/must run units.

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

(Equation 1 of the "Tool to calculate the emission factor for an electricity system" Version 03.0.0)

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year *y* (tonnes CO_2/MWh)

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

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

m = All power units serving the grid in year *y* except low-cost / must-run power units

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

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

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

Option A2. If for a power unit *m* only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

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

(Equation 3 of the "Tool to calculate the emission factor for an electricity system" Version 03.0.0)

Where:

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

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tonnes CO_2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = All power units serving the grid in year *y* except low-cost/must-run power units

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

The values for the $EF_{CO2,m,i,y}$ comes from the lower limit of the 95% confidence level were used, as follows: natural gas 54,300 kg/TJ; oil-based 75,500 kg/TJ; coal (bituminous) 89,500 kg/TJ. (Reference: The lower limit of the 95% confidence interval in accordance with "*Tool to calculate the emission factor for an electricity system*" is used. The values for $EF_{CO2,m,i,y}$ were taken from the Table 1.4, p.1.23 of the Volume 2: Energy, of the 2006 IPCC Guidelines for National Greenhouse Gas Inventory).

The parameter $\eta_{m,y}$ is taken from Appendix 1, page 33, “Default efficiency factors for power plants” of the **Methodological Tool (Version 03.0.0) “Tool to calculate the emission factor for an electricity system” and have the following values:**

Natural gas – 46% for combined cycle, old units (before and in 2000)
60% for combined cycle, new units (after 2000)

Coal - 36.5% for old units (before and in 2000)

Oil - 37.5% for old units (before and in 2000)
39% new units (after 2000)

All the parameters used in the calculations are described in section B.6.2 of this PDD.

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ should be determined as per the provisions in the monitoring Tables.

The next page shows the OM calculation.

OM Calculation:

	Net Generation (MWh)			
	2009	**2010**	**2011**	**Total (2009-2011)**
Coal-Fired	13,387,348	19,566,697	21,458,502	54,412,547
Oil-Based	3,120,455	4,268,124	1,018,764	8,407,343
Natural Gas-Based	19,490,679	19,137,438	20,193,109	58,821,226
Total Net Generation	**35,998,482**	**42,972,259**	**42,670,375**	**121,641,116**

OM Calculation (2009-2011)							E
	A	**B**	**C = A*B**	**D**	**E**	**F = (C*D)/E**	**G**
Item	**Fuel Emission Factor**	**Conversion (kg/TJ to tons/GJ)**		**GJ/MWh**	**Ave. net energy conversion efficiency of power unit**	**CO_2 emission factor of power unit**	**E(**
Parameter	$EF_{CO2,m,i,y}$	factor	$EF_{CO2,m,i,y}$	factor	$\eta_{m,y}$	$EF_{EL,m,y}$	
Data Source	IPCC	-	-	-	Annex 1, am-tool-07-v2.2.1	calculated	2009
Unit	kg CO_2/TJ	(ratio)	tCO_2/GJ	(ratio)	(ratio)	tCO_2/MWh	tCO_2
Coal-Fired	89,500	1.00E-06	0.08950	3.6	0.370	0.8708	11,657,847
Oil-Based	75,500	1.00E-06	0.07550	3.6	0.375	0.7248	2,261,706
Natural Gas-Based	54,300	1.00E-06	0.05430	3.6	0.600	0.3258	6,350,063
TOTAL							**20,269,616**
						EF_{OM} (yearly basis), tCO_2/MWh	0.563

Column Legend:
A – Fuel Emission Factor
B – Conversion Factor (kg/TJ to tons/GJ)
D – Conversion Factor (GJ/MWh)
E – Efficiency of power unit
F – Emission factor of the power unit
G, H, I

Formula (if applicable):
C = A*B
F = (C*D)/E
Columns G,H,I = (electricity generated for the corresponding year) (F)

The **OM is 0.595**. (Attachment 2).

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

Option 1 is chosen, which is: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Identify the group of power units to be included in the build margin

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

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

	Net Generation in 2011 (MWh)	Year Started to Supply Electricity to the Grid
Panay Energy Devt Corp (Coal)	660,275	Nov 2010 (Unit 1), Apr 2011 (Unit 2)
Laguna Landfill	8,339	Mar-11
CASA Bioenergy (Bagasse)	7,541	Mar-11
Cebu Energy Devt Corp (Coal)	1,291,911	Apr 2010 (U1), Jun 2010 (U2), Jan 2011 (U3)
KEPCO-Salcon (Coal)	870,902	Nov 2010
AEG_{Set5}	**2,838,967**	

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

In this calculation, (b) will be used, the most recently built plants that comprise around 20% of the system generation in MWh was used. Please see file "Recently Built Power Plants for CDM 2011.xls" obtained from the Philippine Department of Energy.

If only 13 plants are included (without Ilijan Natural Gas Power Plant), these will only comprise of 14.49% of the total recently-built plants of the Luzon-Visayas grid as follows (Note: CDM registered projects are not included in the calculations, per the methodology):

Most Recently-Built Plants, Luzon-Visayas Grid:

	PLANT	Commissioning date	Fuel	2011 Net Power Generation (MWh)
1	Laguna Landfill Gas	Mar-11	Landfill Gas	8,339
2	CASA Bioenergy	Mar-11	Biomass	7,541
3	Panay Energy Devt Corp (Coal)	Apr-11	Coal	660,275
4	Cebu Energy Devt Corp (Coal)	Jan-11	Coal	1,291,911
5	KEPCO-Salcon Coal	Nov-10	Coal	870,902
6	Sevilla Hydroelectric Plant	Nov-08	Hydro	11,043
7	Northern Negros Geothermal	Jan-07	Geothermal	12,220
8	5 MW Bunker GBPC	Sep-06	Oil	3,587
9	12.5 MW Bunker GBPC	Aug-06	Oil	13,843
10	20 MW Bunker GBPC	Feb-06	Oil	1,195
11	Guimaras Power	Apr-05	Oil	3,323
12	San Roque Hydro	May-03	Hydro	1,041,172
13	San Lorenzo Natural Gas	Sep-02	Natural Gas	4,113,962
14	Ilijan Natural Gas	Jun-02	Natural Gas	7,962,619
	$AEG_{Set \geq 20\%}$			16,001,929
	% of AEG(total)			28.8%

Represents only 14.49% of AEG(total) (plants 1–13)

Adding 'Ilijan Natural Gas Plant (commissioned June 2002) as the 14th $AEG_{SET\text{-}\geq 20\%}$ plant to the above 13 plants, the total generation of the 14 $AEG_{SET\text{-}\geq 20\%}$ plants will now become 16,001,929 MWh, which is 28.8% of AEG_{total} (CDM projects not included, per methodology).

Based on the "Tool to calculate the emission factor for an electricity system, version 03.0.0, EB70, "If 20% falls on part capacity of a unit, that unit is fully included in the calculation". Since 20% fell on the Ilijan Natural Gas Plant, its full generation shall be included in the calculation.

Hence, since $AEG_{Set5} < AEG_{Set \geq 20\%}$, use $SET_{sample} = SET_{\geq 20\%}$.

Per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0, page 15, paragraph *c*), since none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case steps (d), (e) and (f) were ignored.

The build margin (BM) emission factor

The build margin emissions factor is the generation-weighted average emission factor (t CO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

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

(Equation 13 of the "Tool to calculate the emission factor for an electricity system" Version 03.0.0)

Where:

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

The power units included in the build margin corresponded to the sample group m then, as a conservative

approach, only option A2 from guidance in Step 4 section 6.4.2 is used and the default values provided in Appendix 1 is used to determine the parameter $\eta_{m,y}$ for the power units that started to supply electricity to the grid more than 10 years ago.

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined per the guidance in Step 4 (a) for the simple OM, using option A2 using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

The next page shows the BM calculation.

BM Calculation:

	2011 Net Generation of *m* plants $EG_{m,y}$ (MWh)
Coal-Fired	2,823,088
Oil-Based	21,947
Diesel	*0*
Oil Thermal	*21,947*
Natural Gas	12,076,581
Hydroelectric	1,052,214
Geothermal	12,220
Biomass	15,879
Total Net Generation $EG_{m,y}$ (MWh)	**16,001,929**

BM Calculation (2011)

	A	B	C = A*B	D	E	F = (C*D)/E	G
Item	**Fuel Emission Factor**	**Conversion (kg/TJ to tons/GJ)**		**GJ/MWh**	**Ave. net energy conversion efficiency of power unit**	**CO_2 emission factor of power unit**	**$EG_{m,y}$ * $EF_{EL,m,y}$**
Parameter	$EF_{CO2,m,i,y}$	factor	$EF_{CO2,m,i,y}$	factor	$\eta_{m,y}$	$EF_{EL,m,y}$	
Data Source	IPCC	-	-	-	Annex 1, am-tool-07-v2.2.1	calculated	2011
Unit	kg CO_2/TJ	(ratio)	tCO_2/GJ	(ratio)	(ratio)	tCO_2/MWh	tCO_2
Coal-Fired	89,500	1.00E-06	0.08950	3.6	0.390	0.8262	2,332,305
Oil-Based							15,296
Diesel	*72,600*	*1.00E-06*	*0.07260*	*3.6*	*0.390*	*0.6702*	*0*
Oil Thermal	*75,500*	*1.00E-06*	*0.07550*	*3.6*	*0.390*	*0.6969*	*15,296*
Natural Gas	54,300	1.00E-06	0.05430	3.6	0.600	0.3258	3,934,550
Hydroelectric	0	1.00E-06	0.00000	3.6	-	-	-
Geothermal	0	1.00E-06	0.00000	3.6	-	-	-
Biomass	0	1.00E-06	0.00000	3.6	-	-	-
TOTAL							**6,282,150**
						BM	**0.393**

Column Legend:	Formula (if applicable):
A – Fuel Emission Factor	
B – Conversion Factor (kg/TJ to tons/GJ)	C = A*B
D – Conversion Factor (GJ/MWh)	
E – Efficiency of power unit	
F – Emission factor of the power unit	F = (C*D)/E
G	Columns G = (electricity generated for the corresponding year) (F)

The **BM is 0.393**.

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

The combined margin emissions factor is calculated as follows, using the Weighted Average CM:

$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$
(Equation 14 of the "Tool to calculate the emission factor for an electricity system" Version 03.0.0)

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

The following default values should be used for w_{OM} and w_{BM}:
For "all other projects" (includes biomass):

w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period

$EF_{grid,CM,y} = (EF_{grid,OM,y} \text{ x } w_{OM}) + (EF_{grid,BM,y} \text{ x } w_{BM})$
= (0.595 x 0.5) + (0.393 x 0.5)
= **0.494**

Details are in **<u>Attachment 2</u>**.

Appendix 5: Further background information on monitoring plan

Details of the Monitoring Information are described in Section B.7.

Appendix 6: Summary of post registration changes

Not applicable.

Appendix 7: Assumptions

1. Project Financials

INVESTMENT COST ESTIMATE		Unit	Amount
Plant Capital Cost			
EPC Contract	70%	1000 Pesos	1,512,847
Non EPC Contract	12%	1000 Pesos	251,915
Fuel Capital Cost	18%	1000 Pesos	395,774
Total Plant Capital Cost	100%	1000 Pesos	2,160,537
Land cost		1000 Pesos	37,372
Development cost		1000 Pesos	273,043
Other Plant Costs			
Working capital		1000 Pesos	131,181
Start-up Fuel Cost		1000 Pesos	50,000
VAT		1000 Pesos	175,122
Pre-Operating Costs		1000 Pesos	145,127
Total Investment Costs		1000 Pesos	2,972,381
Project contingency		1000 Pesos	115,283
Total Project Cost		1000 Pesos	**3,087,664**
Financing Costs			
Funding of debt service reserve		1000 Pesos	138,799
Upfront financing costs		1000 Pesos	115,696
Commitment fees		1000 Pesos	20,834
Capitalised interest		1000 Pesos	213,277
Total		1000 Pesos	488,606
Total Investment Cost		**1000 Pesos**	**3,576,270**

PROJECT SCHEDULE		
Start of Construction		1-Jul-12
Construction period	years	2
Start of Operation		1-Jul-14

OPERATION & MAINTENANCE COST ESTIMATE, 201	Unit	Amount
Fuel supply & lease costs	1000 Pesos/yr	257,800
Ash disposal cost	1000 Pesos/yr	3,284
Social contributions	1000 Pesos/yr	1,058
O & M materials, maintenance, repair 1st yea	1000 Pesos/yr	29,942
O & M materials, maintenance, repair 2nd yr+	1000 Pesos/yr	45,759
Labour & fringes	1000 Pesos/yr	52,909
Diesel fuel, oil & lubricants	1000 Pesos/yr	5,937
Water costs	1000 Pesos/yr	22,348
Corporate costs	1000 Pesos/yr	69,007
Property & Local taxes	1000 Pesos/yr	26,477

O&M materials, Repairs & Maintenance Assumptions	Unit	Rate
Plant Spare Parts	(% of capital costs)	18.00%
Mobile equipment maint & repair	(% of capital costs)	10.00%
Main plant R&M (TG and Boiler)	(% of capital costs)	3.00%
Prodn Materials (TG and Boiler)	(% of capital costs)	1.20%
Diesel Fuel, Oil & lubricants - (Boiler and Pla	(% of capital costs)	1.00%
Water price	P/tonne	18.00
Mobile equipment annual replacement	(% of capital costs)	10.00%

Corporate Cost Assumptions	Unit	Rate
Plant insurance	(% of capital costs)	0.30%
Mobile and Fuel Equipment insurance	(% of capital costs)	0.30%
Administration costs	(% of revenue)	1.10%
Management Cost	(% of revenue)	3.25%
DENR permits	transport permit pe	500,000

PRODUCTION INPUTS AND OUTPUTS	Unit	Amount
Gross plant capacity	kW	18,000
Gross generation capacity	kWh/year	157,680,000
Auxiliary load	%	10.5%
Plant availability	%	90%
Net power plant capacity	kW	16,110
Net generation capacity	kWh/year	141,123,600
Net plant generation	kWh/year	127,011,240
Days in a year	days/year	365
No of hours in a year	hours/year	8,760

Carbon credits, CERs	tons	64,298
Operating year		
1		63,559
2		63,736
3		63,953
4		64,267
5		64,503
6		64,298
7		64,298
8		64,298
9		64,298
10		64,298
11		64,298
12		64,298
13		64,298
14		64,298
15		64,298
16		64,298
17		64,298
18		64,298
19		64,298
20		64,298
Total		1,284,492

PRICES AND COSTS, 2014		Unit	**Amount**
Electricity price - firm	For year 2011	Pesos/kWh	6.6300
Average Cost		Pesos/ton	1,291

FINANCING ASSUMPTIONS	Unit	Amount
Project cost to be financed by loan		70%
Loan committed amount	1000 Pesos	2,510,000
Amount to be financed by loan	1000 Pesos	2,504,269
Amount to be financed by SH capital	1000 Pesos	1,072,001
Total	1000 Pesos	3,576,270
Loan terms:		
Up-front fees	1000 Pesos	115,696
Commitment fees		20,834
Interest rate during construction		8.50%
Interest rate during operation		8.50%
Interest on cash		0.00%
Loan repayment period	years	12.5
Loan repayment grace period	years	2.0
Dividend payment policy		100%
Debt Service Reserve Account	months	6.00
Repayment method		predetermined
Operating year		principal portior
1		2.32%
2		4.94%
3		5.37%
4		5.84%
5		6.35%
6		6.90%
7		7.49%
8		8.15%
9		8.85%
10		9.62%
11		10.46%
12		11.36%
13		12.35%
14		0.00%
15		0.00%
16		0.00%
17		0.00%
18		0.00%
19		0.00%
20		0.00%
Total		100.00%

ESCALATION ASSUMPTIONS		
Fuel costs	%/year	3.9%
Social contributions	%/year	3.8%
O & M materials, maintenance, repair	%/year	4.8%
Labour & fringes	%/year	4.8%
Diesel fuel, oil & lubricants	%/year	4.0%
Water costs	%/year	4.0%
Corporate costs	%/year	4.0%
Insurance	%/year	4.0%
Land lease	%/year	4.0%
Electricity tariff	%/year	3.0%
Carbon credits	%/year	4.0%
Local & Property Taxes	%/year	0.0%

TAXATION		
Corporate income tax rate - % of taxable income		10.0%
Corporate income tax holiday	years	7.00
Tax on income from sale of carbon credits		0.0%

DEPRECIATION		
Equipment - % of total	years	20
Buildings/Construction - % of total	years	20
Pre-operating costs	years	20
Financing costs	years	20
Land	years	infinite

FOREIGN EXCHANGE RATES		
Philippine Peso vs. US Dollar	Pesos/USD	42.6

2. CER Calculation

Type of Biomass Fuel	AVD_y - Round trip distance	TL_y - Truck Capacity (ton)
Cane Trash	80	15
Woody Energy Crop Plantations (ECP)	40	20
Grassy Energy Crop Plantations (ECP)	40	15
Woody residues/thinnings	80	20
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	60	15

Type of Biomass Fuel	NCV	Unit
Cane Trash	0.00973	TJ/Ton

BE1 -Biomass Fuel Mix at the Boiler-in-Take (BIT) Quantity

Type of Biomass Fuel	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Sugar Cane Trash	80,217	80,217	83,426	96,261	96,261	96,261	96,261
Woody Energy Crop Plantations (ECP)	-	-	5,260	5,260	5,824	11,648	11,648
Grassy Energy Crop Plantations (ECP)	3,100	6,201	12,401	18,602	24,803	40,527	40,527
Woody residues/thinnings from Current Tree Stands	56,550	53,919	40,768	24,987	19,163	-	-
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	6,088	6,088	6,088	6,088	6,088	6,088	6,088
TOTAL	145,956	146,426	147,945	151,199	152,139	154,524	154,524

Quantity of Biomass Transported (Delivered Quantity)

Type of Biomass Fuel	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Cane Trash	84,439	84,439	87,817	101,327	101,327	101,327	101,327
Woody Energy Crop Plantations (ECP)	-	-	8,074	8,074	8,939	17,878	17,878
Grassy Energy Crop Plantations (ECP)	6,061	12,122	24,243	36,365	48,487	79,225	79,225
Woody residues/thinnings	82,763	62,577	38,354	29,414	-	-	-
Other Biomass (Coconut, rice husk/straw, corn cobs/stalks or bamboo)	9,613	9,613	9,613	9,613	9,613	9,613	9,613
TOTAL	182,876	168,751	168,101	184,794	168,366	208,044	208,044

Appendix 8: Awarded Biomass Contracts

AWARDED BIOMASS PROJECTS as of November 2012 (with BREOC)

ISLAND / GRID	REGION	PROVINCE	CITY / MUNICIPALITY	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)	INSTALLED CAPACITY (MW)
Luzon	I	La Union	Rosario	1 MW Biomass Energy Project for Pepsi Rosario, La Union	Sure PEP, Inc.	1.00	0.00
	II	Isabela	Alicia	7.2 MW Rice Hull Gasification	Lucky PPH International, Inc.	3.60	3.60
			San Mariano	9 MW Bagasse-fired Cogeneration Power Plant	Green Future Innovations Inc.	19.00	0.00
	III	Bataan	Samal	12.5 MW Bataan 2020 Rice hull-fired Cogen Plant	Bataan 2020 Inc.	0.00	12.50
		Bulacan	San Ildefonso	Excel Farm Methane Recovery and Electricity Generation Project	Solutions Using Renewable Energy Inc.	0.00	0.20
			San Miguel	0.9 MW RF#12 Biogas Power Generation System	Hacienda Bio-Energy Inc.	0.00	0.90
			Sta. Maria	Amigo Farm Methane Recovery and Electricity Generation Project	Solutions Using Renewable Energy Inc.	0.00	0.15
			Bocaue	1 MW Bocaue Biogas to Electricity Facility	Sage Equipment and Consulting Group, Inc.	1.00	0.00
		Nueva Ecija	San Jose City	9.9 MWe (net) SJCiPower Rice husk-Fired Biomass power Plant Project	San Jose City I Power Corporation	11.00	0.00
			San Leonardo	17.5 MW Nueve Ecija Multi-Fuel Biomass Power Generation Facility	Green Power Nueva Ecija Phils. Inc.	17.50	0.00
		Aurora	Dinalungan	500 KW Ecomarket Solutions Woody Biomass Power Plant	EcoMarketSolutions, Inc	0.50	0.00
			Dilasag	1.5 MW Ecomarket Solutions Woody Biomass Power Plant	EcoMarketSolutions, Inc	1.50	0.00
	IV-A	Laguna	San Pedro	4 MW San Pedro Landfill Methane Recovery and Electricity Generation	Bacavalley Energy Inc.	0.00	4.00
		Quezon	Unisan	11.2 MW Unisan Biomass Power Plant using Coconut Wastes	Unisan Biogen Corporation	11.20	
		Rizal	Rodriguez	14.8 MW Montalban Landfill Methane Recovery and Electricity Generation	Montalban Methane Power Corporation	0.00	14.80

Luzon	**NCR**	Metro Manila	**Quezon City**	1.2 MW Payatas Landfill Methane Recovery and Power Generation Facility	Pangea Green Energy Philippines, Inc.	1.00	0.20
	V	Camarines Sur	**Naga**	20 MW Waste-to-Energy Project using Thermal Gasifier Conversion	CJ Global Green Energy Philippines Corp	20.00	0.00
Luzon Sum						**87.30**	**36.35**
Visayas	**VI**	Aklan	**Banga**	12 MW Aklan Multi-Fuel Biomass Power Plant	Asea One Power Corp.	12.00	
		Iloilo	**Ajuy**	30 MW Ajuy Multi-Fuel Biomass Power Generation Project	Asea One Power Corp.	30.00	0.00
			Mina	35.0 MW Mina Multi-Fuel Biomass Power Generation Facility	Green Power Panay Phils., Inc	35.00	0.00
			Passi City	15 MW CASA Bagasse-Fired Cogeneration Facility	Central Azucarera de San Antonio	0.00	15.00
		Negros Occidental	**San Carlos City**	8 MW SCBI Bagasse Cogeneration Plant	San Carlos Bioenergy Inc.	0.00	8.00
				18 MW SCBiopower Bagasse-Fired Power Generation Project	San Carlos Biopower Inc.	18.00	0.00
			Talisay City	21 MW FFHC Bagasse Cogeneration System	First Farmers Holding Corp.	0.00	21.00
			Victorias City	26 MW VMCI Bagasse-Fired Cogeneration Plant	Victorias Milling Company Inc.	0.00	18.00
	VII	Cebu	**Consolacion**	Consolacion Landfill Methane Recovery and Electricity Generation	Asian Energysystems Corporation	4.00	0.00
Visayas Sum						**99.00**	**62.00**
Mindanao	**X**	Bukidnon	**Maramag**	21 MW CSCI Bagasse-Fired Cogeneration Facility	Crystal Sugar Company, Inc.	0.00	21.00
Mindanao Sum						**0.00**	**21.00**
Grand Total						**186.30**	**119.35**

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