CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1. Title of the small-scale project activity:

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Heat and Electricity Cogeneration Project Employing Renewable Biomass in East Java, Indonesia
Version 1: 12/February/2009

A.2. Description of the small-scale project activity:

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■ **Plant implementing the project activity**

PT. Kutai Timber Indonesia (KTI)

Location	Probolinggo, East Java, Republic of Indonesia
Line of business	• Manufacture and sale of plywood, processed wood products, particle board (PB) * The PB plant began commercial production in January 2008 • The plant has ISO 9001 and 14001 certification (The PB plant expects to acquire certification in 2009)
Plant area	Plywood/building materials plants: 246,500m^2 PB plant: 110,000m^2
Production capacity	Plywood: 12,000m^3/month Building materials: 5,000m^3/month PB: 11,000m^3/month

■ **Purpose of the project activity**

The purpose of the project activity is to reduce greenhouse gas (GHG) emissions. The activity will involve the introduction of cogeneration equipment that employs renewable biomass, with wood biomass as the main fuel.

The new equipment will consist of a cogeneration system able to generate 4.5MW of electricity and 6.5MW of thermal energy that will displace electrical energy used by the PB plant and thermal energy used by the building materials plant.

■ **Greenhouse gas reduction activities**

➢ **Activities prior to the project**

KTI currently draws all its electricity from Indonesia's largest electricity network, PT. PLN's JAMALI grid.

KTI also owns three wood biomass boilers (total steam capacity: 31.0 tons/hr) that produce the steam and heat used in the timber drying process. All fuel used to fire the three wood biomass boilers is wood waste generated during manufacturing processes at the KTI plants.

➢ **Activities to be conducted after project implementation**

The cogeneration system installed in this project will take over electricity supply to the PB plant (capacity: 4.5MW) and displace the energy generated by one of the wood biomass boilers used by the building materials plant (steam capacity: 7.0 tons/hr). The 4.5MW in generated electricity will consist of 3.6MW for plant operation and 0.9MW to be consumed by the power generation facility itself. The heat to be displaced will be equivalent to 6.5MW_{th}. The main fuel used by the system will be wood biomass generated by KTI plants and other plants such as processed wood product plants in the surrounding region. Renewable biomass derived from agricultural waste will also be employed as a fuel. Natural gas will be used as a fuel during renewable biomass shortages or if the power generation facility breaks down. Fewer GHG emissions are generated when using natural gas as a fuel than when using petroleum or coal.

On installation of the new system, one of the wood biomass boilers will cease to operate. The boiler will remain on the premises, however, for use in emergencies or during maintenance. The basic electricity supply agreement with PLN will be maintained in order that electricity may be drawn from the JAMALI grid as required—in emergencies, for example.

■ **GHG reductions to be achieved through the project activity**

The GHG to be reduced through this project is carbon dioxide (CO_2). Baseline GHG emissions from steam and thermal energy production will be 0t-CO_2 because plant-generated wood waste will be used as at present. It follows that the GHG reduction to be achieved will be the reduction achieved by replacing electricity currently drawn from the JAMALI grid with electricity generated by the new equipment. (Baseline details are provided in Section B.4.)

The PB plant began commercial production in January 2008. Output began to increase and approximately 2.1MW of electricity was required in the period from May to November, in which output exceeded 6,000m^3/month. Multiplying this by daily hours of operation (24 hours) and the annual number of operating days (330 days) to compute the baseline electricity production, we reach an annual requirement of 16,632MWh/yr.

Displacing this electricity supply would be expected to reduce emissions by 14,819t-CO_2/yr, which is reached by multiplying the displaced amount by the emission factor for the JAMALI grid, 0.891t-CO_2/MWh. In Section B.6.3 "Ex-ante calculation of emission reductions," project emissions are calculated as 189t-CO_2/yr and leakage is calculated as 2,458t-CO_2/yr, meaning reductions of 12,172t-CO_2/yr are anticipated overall. The crediting period is expected to be a total of 21 years – a seven-year period renewed twice.

■ **Contribution of the project activities to sustainable development**

➢ **Contribution to Indonesia's national energy policy**

Indonesia's national energy policy is stipulated under Presidential Regulation No. 5/2006. The policy states that Indonesia has become a net importer of petroleum and sets a target to reduce the utilization of oil as a percentage of major energy sources to 20% or less by 2025. Specific values are shown in Table 1.

Table 1 National energy policy of Indonesia

Form of energy	2025 target
Oil	20% or less
Natural gas	30% or more
Coal	33% or more
Biofuel	5% or more
Geothermal energy	5% or more
Alternative energy (New energy and renewable energy sources, etc.)	5% or more
Liquefied coal	2% or more

The use of wood biomass and other renewable biomass for this project activity increases the percentage of alternative energy utilization and is consistent with national policy, thereby contributing to sustainable development.

- **Contribution to the local economy and stable electricity supply**

An increasing number of corporations in Indonesia are discontinuing captive power generation fueled by petroleum products due to higher prices for those products and are instead switching to coal-fired power generation or are purchasing electricity from PLN. The JAMALI grid from which KTI draws its electricity supply, however, does not have enough supply resources to be able to supplement the electricity available along its network. Electricity is thus in short supply and power cuts are systematically implemented. (Source: JIJI News Bulletin, June 2, 2008)

By ceasing to import from the JAMALI grid and engaging in captive power generation, KTI will be assisting stable electricity supply. Ongoing use of wood biomass and other renewable biomass by KTI will also expand profits for timber companies and owners of agricultural businesses and transportation companies and provide greater job opportunities. The local community is expected to benefit from sustainable development, including an improved standard of living.

- **Contribution to the reduction of environmental impact**

The use of renewable biomass as a fuel will reduce GHG emissions, contributing to efforts to curb global warming. The use of renewable biomass will also help prevent air pollution through greater reductions of particulate matter and carbon monoxide emissions than are achievable when employing fossil fuels.

A dust collector will be installed, able to restrict particulate matter emissions to $120mg/m^3$, well within the $350mg/m^3$ standard prescribed by the province of East Java (Source: East Java Provincial Regulation No. 39/2008)

A.3. <u>Project participants</u>:

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Table 2 Project participants

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Indonesia (host country)	PT. Kutai Timber Indonesia	No
Japan	Sumitomo Forestry Co., Ltd.	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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Republic of Indonesia

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

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East Java

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

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Probolinggo

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

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The project site—the KTI plant—is located in the city of Probolinggo, at the eastern end of the island of Java. Probolinggo is a port city roughly 100km− a two-hour drive− from Surabaya, the capital of East Java province. The plant is situated in the northern area of Probolinggo, facing the Java Sea (GPS coordinates: 7°43’46.24”S, 113°13’6.86”E) (Fig. 1).

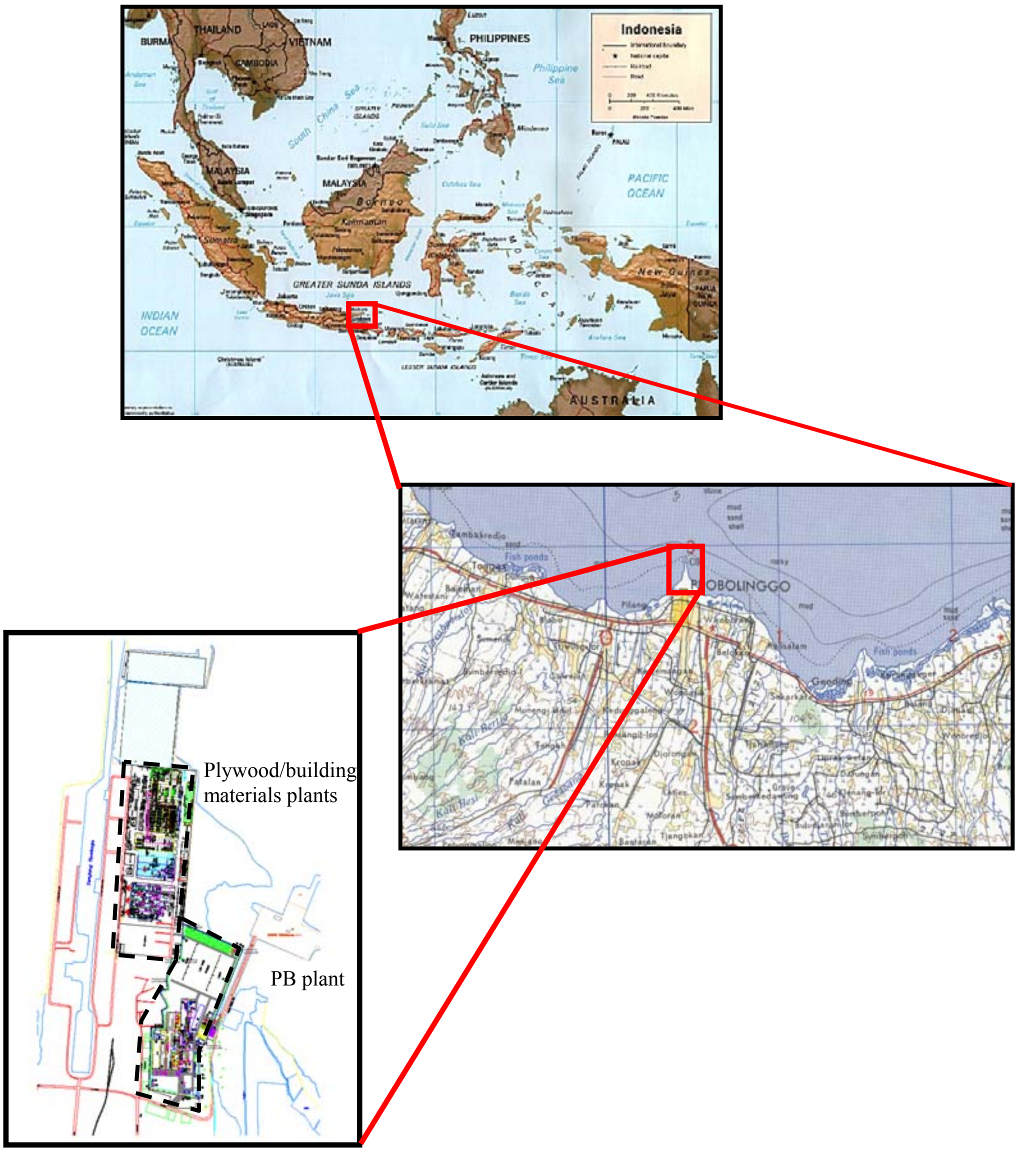

Fig. 1 Project site
(Source: http://www.lib.utexas.edu/maps/indonesia.html#country.html)

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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- **Type**

Type I: Renewable energy projects (hereinafter, “Type I”)

- **Categories**

I.C. version 13: Thermal energy for the user with or without electricity
I.D. version 13: Grid connected renewable electricity generation

- **Equipment for the project activity**

Fig. 2 is an outline of the equipment to be installed.

The new equipment will consist of a cogeneration system able to generate 4.5MW of electricity and 7.0t-steam/hr. The boiler has a capacity to produce 45.0t-steam/hr and has a thermal efficiency of 84%.The efficiency of electricity generation is 14.3%.

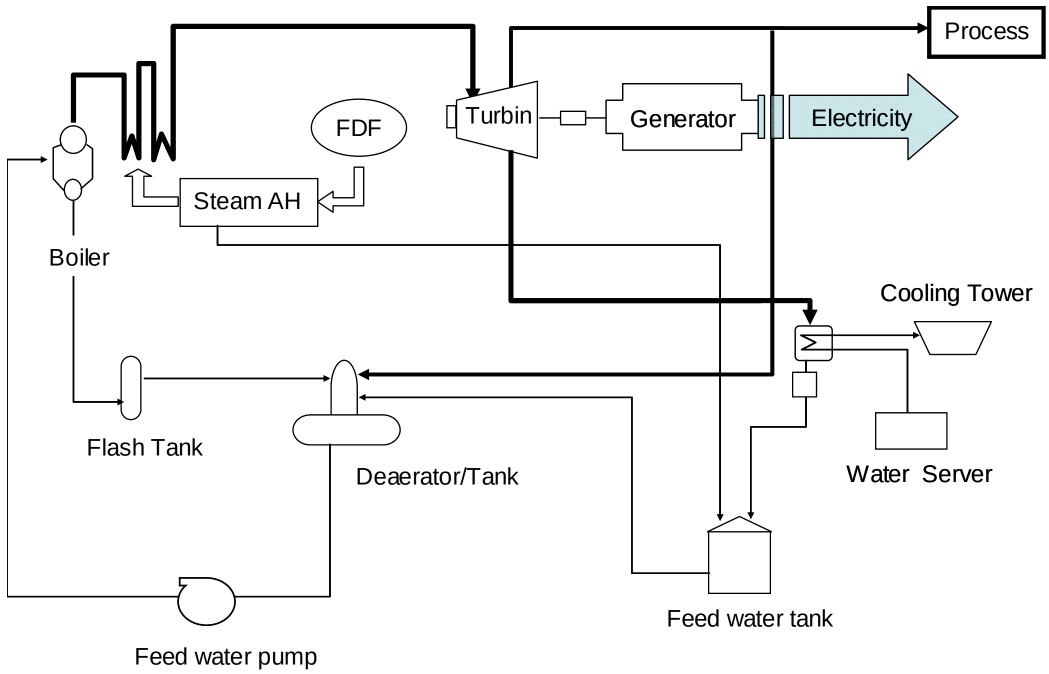

Fig. 2 Outline of the new equipment

A.4.3. Estimated amount of emission reductions over the chosen crediting period:

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Table 3 Annual emission reductions in first crediting period

Year		Estimated carbon dioxide emission reductions in first crediting period (t-CO_2)
2011		12,172
2012		12,172
2013		12,172
2014		12,172
2015		12,172
2016		12,172
2017		12,172
Estimated reductions (t-CO_2)	Total	85,204
	Average	12,172

A.4.4. Public funding of the small-scale project activity:

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This project is not assisted by public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

It is necessary to confirm, under Appendix C of the Simplified Modalities and Procedures for Small-scale CDM project activities, that the project activity is not a debundled component of a large-scale project activity.

A project is deemed a debundled component if another project exists:

- with the same project participants;
- in the same project category and technology/measure;and
- registered within the previous 2 years; and
- whose project boundary is within 1km of the boundary of the proposed small-scale activity at the closest point.

This project activity is KTI's first CDM project and the above four criteria do not apply. The project activity is thus not a debundled component of a large-scale CDM project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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This project activity falls under the definition of a small-scale CDM project activity and therefore falls under the following two categories, as indicated in Appendix B of the Simplified Modalities and Procedures for Small-scale CDM project activities.

Table 4 Methodologies applied

Title	Reference documentation
Thermal energy for the user with or without electricity	AMS I.C./version 13 EB 38 Valid from 28 Mar 08 onwards
Grid connected renewable electricity generation	AMS I.D./version 13 EB36 Valid from 14 Dec 07 onwards

B.2 Justification of the choice of the project category:

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This project activity will generate less than 15MW of electricity and achieve emission reductions less than 60,000t-CO_2 annually. It therefore falls under the definition of a "small-scale CDM project activity." The project activity will use renewable wood biomass as a fuel, thus conforming to "Type I" small-scale methodology.

Project activities involving the introduction of "renewable biomass-based co-generating systems that produce heat and electricity" with heat generation capacity less than 45MW_{th} must conform to methodology AMS I.C. The baseline for projects displacing electricity imported from a grid is to be calculated as provided for in AMS I.D. (Methodology AMS I.C. paragraphs 1, 2, and 9)

B.3. Description of the project boundary:

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The project boundary is delineated by the "The physical, geographical site of the renewable energy generation" as stated in small-scale CDM methodology—AMS I.C. paragraph 5 and AMS I.D. paragraph 7. Electricity will sometimes be supplied by PLN, such as in emergencies and during maintenance. (Fig. 3)

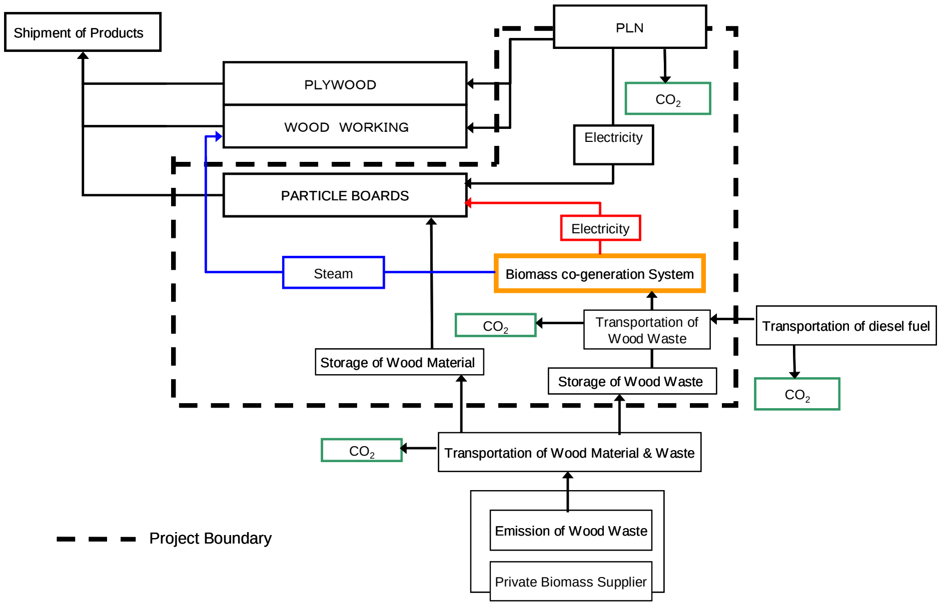

Fig. 3 Project boundary

GHGs included in the project are indicated in Table 5.

Table 5. GHGs included in the project

	Source	GHG	Included or excluded	Explanation
Baseline emissions	Importing electricity from the JAMALI grid	CO_2	Included	The main GHG.
		CH_4	Excluded	Not included for simplification purposes and to avoid acquiring too many credits. This is conservative.
		N_2O	Excluded	Not included for simplification purposes and to avoid acquiring too many credits. This is conservative.
	Use of wood biomass boiler	—	—	No emissions.
Project emissions	Emissions resulting from burning renewable biomass	—	—	No emissions.
	Emissions resulting from importing electricity from the JAMALI grid	CO_2	Included	The main GHG.
		CH_4	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		N_2O	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.

	Emissions resulting from diesel generator operation	CO_2	Included	The main GHG.
		CH_4	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		N_2O	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
	Emissions resulting from wheel loader operation	CO_2	Included	The main GHG.
		CH_4	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		N_2O	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
Leakage	Emissions resulting from transfer of equipment	—	—	No emissions
	Emissions resulting from competing use of renewable biomass	—	—	No emissions
	Emissions resulting from fuel delivery	CO_2	Included	The main GHG
		CH_4	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		N_2O	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
	Emissions resulting from transport of combustion ash	CO_2	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		CH_4	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.
		N_2O	Excluded	Not included due to the low level of emissions and for simplification purposes. This is conservative.

B.4. Description of baseline and its development:

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The following are baseline options for projects that involve the installation of cogeneration equipment. (See small-scale methodology—AMS I.C. ver.13 paragraph 7.)

(a) Electricity is imported from the grid and steam/heat is produced using fossil fuel

This is one of the most viable baselines. The option is not economically attractive, however, since shifting to a fossil fuel based steam/heat production system for the heat portion would require modifications to existing boilers or the installation of new equipment. Additionally, switching to fossil fuels for steam/heat production would lead to greater CO_2 emissions than currently generated by the wood biomass boilers. From the viewpoint of acquiring too many credits as well this cannot be the baseline scenario.

(b) Electricity is produced in an on-site captive power plant (with a possibility of export to the grid) and steam/heat is produced using fossil fuel

KTI has a diesel-powered generator (capacity: 0.45MW) in its PB plant. Capacity is low, however, and insufficient for supplying all the electricity required by the plant. New power generation equipment would thus need to be installed. As with (a) above, therefore, this option cannot be the baseline scenario for economical reasons and to avoid acquiring too many credits.

(c) A combination of (a) and (b)

In consideration of (a) and (b) above, this option cannot be the baseline scenario for economical reasons and to avoid acquiring too many credits.

(d) Electricity and steam/heat are produced in a cogeneration unit, using fossil fuel

KTI does not currently own a cogeneration unit. As with (a), (b) and (c) above, therefore, this option cannot be the baseline scenario for economical reasons and to avoid acquiring too many credits.

(e) Electricity is imported from the grid and/or produced in an on-site captive power plant (with a possibility of export to the grid); steam/heat is produced from renewable biomass

This is the most realistic baseline scenario as it is identical to the current system and requires no additional investment. In the absence of the project activity, therefore, maintaining the current system can be considered.

In consideration of the above, option (e)—Electricity is imported from the grid and/or produced in an on-site captive power plant; steam/heat is produced from renewable biomass—should be the baseline, consistent with the system currently in place.

Baseline emissions in the case of option (e), as indicated in AMS I.C. paragraphs 11 and 14, will be the sum of GHG emissions resulting from importing electricity from the grid and GHG emissions resulting from producing steam/heat.

As only wood biomass is used for the production of steam/heat, the steam/heat portion will not be included for calculating baseline emissions. Only the electrical energy portion will be included, i.e., the electricity currently imported from the JAMALI grid that will be replaced by electricity generated by the new equipment. The displaced amount shall be defined as the baseline electricity production (**EG**,y). Baseline emissions for electricity imported from the grid shall be calculated in line with AMS I.D. paragraph 9 (a) (AMS I.C. paragraph 9).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The equipment installed under this project activity will allow KTI to switch from importing electricity from the JAMALI grid to using captive power generation employing renewable biomass. It is obvious, therefore, that GHG emissions will decrease by implementing the project activity. The following barriers to implementing the activity exist, however, and it can be assumed that the activity would not be carried out if it were not designated a CDM project activity.

- **Investment barriers**

The internal rate of return (IRR) of the activity was estimated using the following trial values.

IRR trial values

- Investment funds: US$8.2 million
- Activity duration: 20 years
- Investment recovery period: 10 years

➢ **IRR estimation considering variations in CER price**

The outcome of CER price and IRR estimates calculated based on the above trial values are shown in Table 6.

With the revenue from CER sales, the IRR would be expected to fall below the weighted average cost of capital, making the project activity an unworkable investment. The activity would also be an unworkable investment if the investment recovery period were longer than 10 years. Details of the calculations are provided in Annex 5.

Table 6 Estimated IRR at varying CER price settings

With/without CERs	CER price		
	US$30	US$20	US$10
With	3.6%	1.9%	0%
Without		-2.1%	

➢ **IRR estimation considering variations in renewable biomass purchasing costs and the cost of importing electricity from the grid**

In order to determine the best business scenario compared to the status quo, a sensitivity analysis was carried out using the variations in parameters with the largest influence on the IRR: renewable biomass purchasing costs (which make up roughly 80% of total costs), and the price of electricity purchased from the grid. The range of variability for renewable biomass purchasing costs was set at -20% to +20%. The current average price of the grid electricity KTI consumes is 1,120 Rp/kWh. A hearing with PLN indicated the future possibility of electricity costs rising to 1,300Rp; calculations were thus made at 1,100 Rp/kWh, 1,200 Rp/kWh, and 1,300 Rp/kWh.The price of credits was fixed at US$20.

The result of calculations is shown in Table 7. Tables 7 confirm that the IRR increases with lower renewable biomass purchasing costs and higher electricity bills from PLN.

Table 7 Estimated IRR with varying renewable biomass purchasing costs and grid electricity prices

Renewable biomass purchasing cost variability range	With/without CERs	Price of energy purchased from grid		
		1,300Rp/kWh	1,200Rp/kWh	1,100Rp/kWh、
-20%	With	10.9%	8.7%	6.2%
	Without	9.2%	6.6%	3.4%
-10%	With	9.1%	6.6%	3.8%
	Without	7.0%	3.9%	0.4%
0%	With	7.1%	4.3%	1.3%
	Without	4.5%	1.1%	-3.1%
+10%	With	4.8%	1.8%	-1.5%
	Without	1.7%	-2.2%	—
+20%	With	2.4%	-0.8%	-4.9%
	Without	-1.4%	—	—

■ **Barriers due to prevailing practices**

➢ **Renewable biomass power generation**

Indonesia has frameworks in place to ensure a quantitatively stable supply of coal and coal-fired power generation that accounts for the largest proportion of electricity—34% of the total electricity—produced by power stations within the JAMALI grid (RUPTL 2006-2015; PLN 2006).

Domestically, government subsidies for petroleum products were reduced from 2001, forcing an escalation of prices for those products. Many companies were subsequently compelled to adopt alternative energy sources and switched to boilers fueled by abundant coal deposits.

The use of renewable biomass is consistent with Indonesian state policy as it helps to reduce GHG emissions and contributes to the nation's sustainability. There are, however, many barriers to its use. Compared to coal, for example, the use of renewable biomass for power generation demands much labor and time as large volumes of renewable biomass need to be collected from an extremely wide range of sources. Stability of supply, too, is affected by availability, which fluctuates with economic conditions and the time of year. Also, initial investment for biomass power generation facilities is about 15% higher than for coal-fired power generation facilities.

➢ **Energy used by plywood plants on Java**

KTI has long been involved in the timber processing business, having commenced operations at its plywood plant in 1974.

Seven wood product plants including plywood manufacture, including KTI, currently operate on the island of Java. (Table 8)

Table 8 Number of wood product plants including plywood manufacture on Java

Province	Number of plants
Banten	2
Jawa Tengah (Central Java)	1
Jawa Timur (East Java)	4 (incl. KTI)

One characteristic of plywood plants is that roughly 30% of raw materials becomes waste during the process of manufacturing plywood from raw lumber. The seven plants listed above use this waste effectively as a fuel for boilers that produce steam and thermal energy required for the drying process.

Concerning electricity usage, the environments of all seven plants allow them access to the JAMALI grid, Indonesia's largest electricity network, from where they draw their electricity.

In light of the above practices, KTI would be the first to introduce efficient cogeneration facilities for producing heat and electricity. Installation of the cogeneration equipment would enable a reduction of GHG emissions.

The project activity is thus said to have additionality.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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- **Baseline specification (See Section B.4. for details)**

Electricity usage: Purchase of electricity from the JAMALI grid
Heat usage: Use of existing wood biomass boilers

- **Formula for calculating GHG emission reductions**

The following formula will be used to calculate GHG emission reductions.

$ER_{,y} = BE_{,y} - PE_{,y} - L_{,y}$	
$ER_{,y}$	: Annual emission reductions (t-CO_2/yr)
$BE_{,y}$	: Baseline emissions (t-CO_2/yr)
$PE_{,y}$	: Project emissions (t-CO_2/yr)
$L_{,y}$	: Leakage (t-CO_2/yr)

➢ **Baseline emissions ($BE_{,y}$)**

As indicated in Section B.4., the heat portion of the baseline will be produced using wood biomass, a renewable energy source that does not emit greenhouse gases. Baseline emissions for the heat portion will thus be 0t-CO_2/yr. It follows that only the electricity generated by the new equipment utilized by the plant (baseline electricity production) will be used to calculate baseline emissions. Calculations will use the following formula.

$BE_{,y} = EG_{,y} \times EF_{-grid}$	
$BE_{,y}$	: Baseline emissions (t-CO_2/yr)
$EG_{,y}$	: Baseline electricity production (MWh/yr)
EF_{-grid}	: Emission factor for the JAMALI grid (t-CO_2/MWh)

- **Baseline electricity production ($EG_{,y}$)**

Baseline electricity production ($EG_{,y}$) for this project activity will be measured through the monitoring of actual electricity generation. There is a possibility, however, that natural gas will have to be used to compensate for any shortage of renewable biomass if not enough can be obtained.

As stipulated in AMS I.D. paragraphs 16 and 18, when natural gas is used the electricity production measured needs to be adjusted deducting the amount of natural gas consumed, applying the parameters of natural gas specific fuel consumption (t-NG/MWh) and quantity of natural gas consumed (Nm^3/yr).

The formula for calculating baseline electricity production is as follows.

$EG_{,y}$ = MIN($EG_{\text{-actual},y}$ − $EG_{\text{-system-NG},y}$, $EG_{\text{-system-biomass},y}$) = MIN($EG_{\text{-actual},y}$ − ($PEC_{\text{-NG},y}$ × $Den_{\text{-NG}}$) / $SFC_{\text{-NG}}$, Σ[$PEC_{\text{-biomass-i},y}$ /$SFC_{\text{-biomass-i}}$])	
$EG_{,y}$	: Baseline electricity production (MWh/yr)
$EG_{\text{-actual},y}$	: Measurement of Baseline electricity production (MWh/yr)
$EG_{\text{-system-NG},y}$	: Electricity production by the cogeneration system using natural gas energy (MWh/yr)
$EG_{\text{-system-biomass},y}$	: Electricity production by the cogeneration system using renewable biomass energy (MWh/yr)
$SFC_{\text{-NG}}$	: Natural gas specific fuel consumption (t-NG/MWh)
$PEC_{\text{-NG},y}$	: Quantity of natural gas consumed (Nm^3/yr)
$Den_{\text{-NG}}$	: Density of natural gas (t-NG/Nm^3)
$SFC_{\text{-biomass-i}}$	: Renewable biomass *i* specific fuel consumption (t-biomass/MWh)
$PEC_{\text{-biomass-i},y}$	: Quantity of renewable biomass *i* consumed (t-biomass/yr)

At this stage, enough renewable biomass is available for electricity production and we do not expect to use natural gas; therefore $EG_{,y}$ = $EG_{\text{-actual},y}$ = $EG_{\text{-system-biomass},y}$. Measurement of Baseline electricity production ($EG_{\text{-actual},y}$) will be determined through monitoring after implementing the project activity (See Section B.7.1. for details).

Specific fuel consumption for fuel *i* ($SFC_{\text{-i}}$) will be determined in advance using the formula below.

✓ **Specific fuel consumption for fuel *i* ($SFC_{\text{-i}}$)**

The specific fuel consumption for each fuel used will be calculated using the following formula.

$SFC_{\text{-i}}$ = Cp / ($Cal_{\text{-i}}$ /10^3)	
$SFC_{\text{-i}}$	: Specific fuel consumption for fuel *i* (t-NG/MWh or t-biomass/MWh)
Cp	: Calorific value required for electricity production (kcal/MWh)
$Cal_{\text{-i}}$	: Calorific value of fuel *i* used in the project activity (kcal/kg-biomass or kcal/kg-NG)

Fuels it is possible to use include:

Renewable biomass	
Wood biomass (timber offcuts, sawdust, etc.)	Chaff
Rice straw	Coconut fiber
Mushroom beds	—
Fossil fuel	
Natural gas (NG)	

Details on specific fuel consumption for fuel *i* ($SFC_{\text{-i}}$), calorific value of fuel *i* used in the project activity ($Cal_{\text{-i}}$), and calorific value required for electricity production (Cp) are given in Section B.6.2.

- **Emission factor for JAMALI grid (EF-grid)**

The emission factor for the JAMALI grid (**EF**-grid) applied to the project activity shall be 0.754t-CO_2/MWh. That is the emission factor approved by Indonesia's designated national authority (DNA).

(Annex3(1), Indonesia's DNA: http://dna-cdm.menlh.go.id/id/database/)

EF-grid = 0.891 t-CO_2/MWh	
EF-grid	: The emission factor for the JAMALI grid (t-CO_2/MWh)

The emission factor for the JAMALI grid (**EF**-grid) will be recalculated each year based on data provided by Indonesia's DNA. Details are given in Section B.7.1.

- **Project emissions (PE,y)**

Project emissions will be calculated using the following formula.

PE,y = **EM**-biomass,y + **EM**-grid,y + **EM**-diesel power plant,y + **EM**-loader,y	
PE,y	: Project emissions(t-CO_2/yr)
EM-biomass,y	: Emissions resulting from burning renewable biomass (t-CO_2/yr)
EM-grid,y	: Emissions resulting from importing electricity from the grid (t-CO_2/yr)
EM-diesel power plant,y	: Emissions resulting from diesel generator operation (t-CO_2/yr)
EM-loader,y	: Emissions resulting from wheel loader operation (t-CO_2/yr)

- **Emissions resulting from burning renewable biomass (EM-biomass,y)**

GHG emissions resulting from burning renewable biomass can be considered to be 0t-CO_2/yr.

EM-biomass,y = 0t-CO_2/yr

- **Emissions resulting from importing electricity from the grid (EM-grid,y)**

Emissions resulting from importing electricity from the grid will be calculated using the following formula.

EM-grid,y = **EG**-grid,y × **EF**-grid,y	
EM-grid,y	: Emissions resulting from importing electricity from the grid (t-CO_2/yr)
EG-grid,y	: Electricity imported from the grid (MWh/yr)
EF-grid,y	: Emission factor for the JAMALI grid (t-CO_2/MWh)

Electricity imported from the grid (**EG**-grid,y)—in emergencies, for example, or while setting up the facilities—will be determined through monitoring after implementing the project activity (See Section B.7.1. for details).

- **Emissions resulting from diesel generator operation (EM-diesel power plant,y)**

KTI owns a diesel-powered generator with a 0.45MW electricity generation capacity. It may be used, for example, when the supply from PLN is insufficient. Related emissions will be calculated using the following formula.

EM-diesel power plant,y = **PEC**-diesel power plant,y × **EF**-diesel-CO_2 × **Cal**-diesel × **Den**-diesel /10^6	
EM-diesel power plant,y	: Emissions resulting from diesel generator operation (t-CO_2/yr)
PEC-diesel power plant,y	: Quantity of diesel consumed by the diesel generator (liters/yr)

EF-diesel-CO_2	: CO_2 emission factor for diesel (t-CO2/TJ)
Cal-diesel	: Calorific value of diesel (TJ/Gg)
Den-diesel	: Density of diesel (kg/liter)

The quantity of diesel consumed by the diesel generator (**PEC**-diesel power plant,y) will be determined through monitoring after implementing the project activity (See Section B.7.1. for details).

- **Emissions resulting from wheel loader operation (EM-loader,y)**

For this project activity, we will measure GHG emissions generated by diesel consumed by wheel loaders that transport renewable biomass and feed it into the new equipment.

The PB plant currently has two wheel loaders. An additional wheel loader will be purchased after implementation of the project. A distinction will be made between wheel loaders used for transporting PB raw materials and those used for transporting renewable biomass, although a distinction might not be made in some cases. If no distinction is made, it will not be possible to directly measure the quantity of diesel consumed for transporting/feeding renewable biomass used in electricity production.

Where a distinction is possible, emissions resulting from wheel loader operation will be calculated using the following formula.

$EM_{\text{-loader,y}} = PEC_{\text{-fuel-loader for system,y}} \times EF_{\text{-diesel-}CO_2} \times Cal_{\text{-diesel}} \times Den_{\text{-diesel}} / 10^6$	
EM-loader,y	: Emissions resulting from wheel loader operation (t-CO_2/yr)
PEC-fuel-loader for system,y	: Quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system (liters/yr)
EF-diesel-CO_2	: CO_2 emission factor for diesel (t-CO_2/TJ)
Cal-diesel	: Calorific value of diesel (TJ/Gg)
Den-diesel	: Density of diesel (kg/liter)

The CO_2 emission factor for diesel (**EF**-diesel-CO_2), calorific value of diesel (**Cal**-diesel), and density of diesel (**Den**-diesel) will be specified in advance (See Section B.6.2. for details).

In order to determine the quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system (**PEC**-fuel-loader for system,y) where a distinction between uses is not possible, it will be necessary to record the quantity of diesel fed into the wheel loaders and to monitor how much PB raw material and how much renewable biomass is delivered to the cogeneration system. The following calculation will be used.

✓ **Quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system (PEC-fuel -loader for system,y)**

$PEC_{\text{-fuel -loader for system,y}} = PEC_{\text{-fuel-loader,y}} \times (PEC_{\text{-biomass,y}} / (PEC_{\text{-biomass,y}} + PEC_{\text{-material-PB,y}}))$	
PEC-fuel -loader for system,y	: Quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system (liters/yr)
PEC-fuel-loader,y	: Total quantity of diesel consumed by all wheel loaders (liters/yr)
PEC-biomass,y	: Quantity of renewable biomass consumed by the cogeneration system (t-biomass/yr)
PEC-material-PB,y	: Quantity of wood biomass consumed as PB raw material (t-biomass/yr)

The same formula will be used if the number of wheel loaders increases.

The three variables—total quantity of diesel consumed by all wheel loaders (**PEC**-fuel-loader,y), quantity of renewable biomass consumed by the cogeneration system (**PEC**-biomass,y), and quantity of wood biomass consumed as PB raw material (**PEC**-material-PB,y)—will be determined through monitoring (See Section B.7.1. for details).

- **Leakage (L,y)**

The methodologies applied to this project activity state that leakage during transfers of equipment is to be considered (AMS I.C. paragraph 17 and AMS I.D. paragraph 12). In addition, simplified guidelines for small-scale CDM project activities stipulate the policy on leakage resulting from competition among uses for renewable biomass. (Attachment C to Appendix B, EB28 General guidance on leakage in biomass project activities [version02])

Although not required under the methodology, leakage resulting from the delivery of fuel will also be recorded for this project activity to avoid acquiring too many credits. Data recorded will consist of the quantity of diesel consumed by trucks used to collect the renewable biomass and the quantity of diesel consumed by tank trucks that transport diesel used to power the wheel loaders.

Leakage resulting from the transport of combustion ash will not be included in calculations for this project activity. The disposal site is 1km travelling distance from the plant and the rate of ash generation for existing boilers is about 1.5%. This leakage will not be included since the amount of ash generated is 752t-ash (= 50,148 (t-biomass) × 1.5%) and GHG emissions resulting from its transport are low.

Leakage will be calculated using the following formula.

L,y = **EM**-Tf-system,y + **EM**-biomass competition,y + **EM**-Tp-fuel,y	
L,y	: Leakage (t-CO_2/yr)
EM-Tf-system,y	: Leakage resulting from transfer of equipment (t-CO_2/yr)
EM-biomass competition,y	: Leakage resulting from competing use of renewable biomass (t-CO_2/yr)
EM-Tp-fuel,y	: Leakage resulting from fuel delivery (t-CO_2/yr)

- **Leakage resulting from transfer of equipment (EM-Tf-system,y)**

It has been prescribed that if energy generation equipment is transferred to another activity, or if existing equipment is transferred to another activity, through the implementation of a project activity, leakage must be taken into account (AMS I.C. paragraph 17 and AMS I.D. paragraph 12).

The cogeneration system to be installed under this project activity is new equipment and the wood biomass boiler it replaces will remain on site. It follows that no leakage will result from the transfer of equipment.

EM-Tf-system,y = 0t-CO_2/yr

- **Leakage resulting from competing use of renewable biomass (EM-biomass competition,y)**

The renewable biomass to be used for this project activity will include wood waste from timber mills and chaff and other agricultural waste. A preliminary survey on renewable biomass availability indicated the availability of 16,373t-biomass/month, which includes 3,573t/month of wood biomass. KTI estimates total usage will be 4,179t-biomass/month, comprising 3,573t/month of wood biomass and 606t/month of chaff. Supply is thus sufficient. Additionally, more than 25% of the quantity to be used in the project activity will be available in surplus. There is thus no need to take into account leakage resulting from competing use of renewable biomass (See Annex 3 for details).

EM-biomass competition,y = 0t-CO_2/yr

- **Leakage resulting from fuel delivery (EM-Tp-fuel,y)**

The implementation of the project activity will lead to an increase in diesel consumption by trucks used to transport renewable biomass for use as a fuel in power generation and diesel consumption by tank trucks used to deliver fuel for powering wheel loaders. The resulting GHG emissions will be counted as leakage.

This leakage will be calculated using the following formula.

EM-Tp-fuel,y = (**PEC**-Tp-fuel-biomass,y + **PEC**-Tp-fuel-loader,y) × **EF**-diesel-CO_2 × **Cal**-diesel × **Den**-diesel / 10^6	
EM-Tp-fuel,y	: Leakage resulting from fuel delivery (t-CO_2/yr)
PEC-Tp-fuel-biomass,y	: Quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system (liters/yr)
PEC-Tp-fuel-loader,y	: Quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system (liters/yr)
EF-diesel-CO_2	: CO_2 emission factor for diesel (t-CO_2/TJ)
Cal-diesel	: Calorific value of diesel (TJ/Gg)
Den-diesel	: Density of diesel (kg/liter)

The quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system (**PEC**-Tp-fuel-biomass,y) and quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system (**PEC**-Tp-fuel-loader,y) will be verified using the calculations shown below. All other values will be specified in advance (See Section B.6.2. for details).

✓ **Quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system (PEC-Tp-fuel-biomass,y)**

PEC-Tp-fuel-biomass,y = (**PEC**-biomass-outside,y +(**PEC**-biomass-outside,y ×**PWC**-biomass)) / **ATp**-biomass × **D**-biomass/ **M**-biomass	
PEC-Tp-fuel-biomass,y	: Quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system (liters/yr)
PEC-biomass-outside,y	: Quantity of renewable biomass used by the cogeneration system obtained outside the project boundary (t-biomass/yr)
ATp-biomass	: Average load of a renewable biomass collection truck (t-biomass/vehicle/trip)
D-biomass	: Average distance travelled by a renewable biomass collection truck (km/vehicle/trip)
M-biomass	: Renewable biomass collection truck mileage (km/liter)
PWC-biomass	: Renewable biomass moisture content (%)

The average load of a renewable biomass collection truck (**ATp**-biomass) will be 5.0t-biomass, renewable biomass collection truck mileage (**M**-biomass) will be 5.0km/liter, and renewable biomass moisture content (**PWC**-biomass) will be 100%. Moisture content will be a flat 100% in order to simplify monitoring as it would be difficult to specify the moisture content of all renewable biomass collected. The average distance travelled by a renewable biomass collection truck (**D**-biomass) will be fixed at 250km, considering the round-trip journey between the renewable biomass collection point and the KTI plant, which are 124km apart on average. Fixed values will be used for these parameters for this project activity as the margin of error throughout the period of the project is small and the effect on GHG emissions is slight.

The quantity of renewable biomass used by the cogeneration system obtained outside the project boundary ($PEC_{-biomass-outside,y}$) will be calculated using the formula below.

- **Quantity of renewable biomass used by the cogeneration system and obtained outside the project boundary ($PEC_{-biomass-outside,y}$)**

$PEC_{-biomass-outside,y} = PEC_{-biomass,y} - PEC_{-biomass-inside,y}$	
$PEC_{-biomass-outside,y}$	: Quantity of renewable biomass used by the cogeneration system obtained outside the project boundary (t-biomass/yr)
$PEC_{-biomass,y}$	: Quantity of renewable biomass consumed by the cogeneration system (t-biomass/yr)
$PEC_{-biomass-inside,y}$	: Quantity of renewable biomass used by the cogeneration system obtained within the project boundary (t-biomass/yr)

The quantity of renewable biomass consumed by the cogeneration system ($PEC_{-biomass,y}$) and quantity of renewable biomass used by the cogeneration system obtained within the project boundary($PEC_{-biomass-inside,y}$) will be determined through monitoring (See Section B.7.1. for details).

✓ **Quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system ($PEC_{-Tp-fuel-loader,y}$)**

$PEC_{-Tp-fuel-loader,y} = PEC_{-fuel-loader\ for\ system,y} / ATp_{-diesel} \times D_{-diesel} / M_{-diesel}$	
$PEC_{-Tp-fuel-loader,y}$	: Quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system (liters/yr)
$PEC_{-fuel-loader\ for\ system,y}$	: Quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system (liters/yr)
$ATp_{-diesel}$	: Load per diesel delivery truck (liters/vehicle/trip)
$D_{-diesel}$	: Distance travelled per diesel delivery truck (km/vehicle/trip)
$M_{-diesel}$	: Diesel delivery truck mileage (km/liters)

The load of a diesel delivery truck ($ATp_{-diesel}$) will be 16,000 liters and diesel delivery truck mileage ($M_{-diesel}$) will be 3km/liter. Diesel is purchased from a company in Surabaya; therefore the distance travelled by a diesel delivery truck ($D_{-diesel}$) will be 200km, the distance of a round-trip to Surabaya. Fixed values will be used for these parameters for this project activity as the margin of error throughout the period of the project is small and the effect on GHG emissions is slight.

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

Data / Parameter:	**SFC-i**
Data unit:	t-NG/MWh or t-biomass/MWh
Description:	Fuel *i* specific fuel consumption
Source of data used:	Calculated using the formula below
Value applied:	**SFC**-i = **Cp** / (**Cal**-i /10^3) **Cp:** Calorific value required for electricity production (kcal/MWh) **Cal**-i**:** Calorific value of fuel *i* used in the project activity (kcal/kg-biomass or kcal/kg-NG) The results of Specific fuel consumption for fuel *i*(**SFC**-i) calculations are shown below. **Renewable biomass** • Wood biomass: 1.254t-biomass/MWh • Chaff: 1.553t-biomass/MWh • Rice straw: 1.421t-biomass/MWh • Coconut fiber: 1.155t-biomass/MWh • Mushroom beds: 2.135t-biomass/MWh **Fossil fuel** • Natural gas: 0.417t-NG/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	The sources of the two values below used for calculating Specific fuel consumption for fuel *i* (**SFC**-i) are detailed in subsequent **Data / Parameter** entries (See Section B.6.3. for calculation details). **Cp:** Calorific value required for electricity production (kcal/MWh) **Cal**-i**:** Calorific value of fuel *i* used in the project activity (kcal/kg-biomass or kcal/kg-NG)
Any comment:	N/A

Data / Parameter:	**Cp**
Data unit:	kcal/MWh
Description:	Calorific value required for electricity production
Source of data used:	Calculated based on manufacturer's equipment specifications
Value applied:	4,786,911
Justification of the choice of data or description of measurement methods and procedures actually applied:	According to equipment specifications, 21,541,100kcal of energy is necessary to produce 4.5MWh of electricity. The calorific value required for electricity production, therefore, is calculated as follows: 21,541,100 (kcal) / 4.5 (MWh) = 4,786,911kcal/MWh
Any comment:	N/A

Data / Parameter:	**Cal**-i
Data unit:	kcal / kg-biomass or kcal / kg-NG
Description:	Calorific value of fuel *i* used in the project activity
Source of data used:	2006 IPCC Guidelines or measured through testing
Value applied:	**<Renewable biomass>** • Wood biomass: 3,816kcal/kg-biomass (measured) • Chaff: 3,081kcal/kg-biomass (measured) • Rice straw: 3,368kcal/kg-biomass (measured) • Coconut fiber: 4,141kcal/kg-biomass (measured) • Mushroom beds: 2,242kcal/kg-biomass (measured) **<Fossil fuel>** • Natural gas: 11,465kcal/kg-NG (2006 IPCC)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement of calorific values was contracted to ITS (Institut Teknologi Sepuluh Nopember), a research institute in Surabaya. The calorific value used for wood biomass is the value for falcate. Wood biomass other than falcate will be used as the raw material for PB. Falcata will be used as the wood biomass for electricity generation. The calorific value for natural gas was determined using the value given by the 2006 IPCC Guidelines. The value had to be converted from joules (J) into calories (cal). The international calorie (**Inc**), 4.1868J/cal, was used for this conversion. The result was as follows. Natural gas: 48.0 (TJ/Gg) / 4.1868 (J/cal) $\times$ 10^3 = 11,465kcal/kg-NG
Any comment:	N/A

Data / Parameter:	**Den**-NG
Data unit:	t-NG/Nm^3
Description:	Density of natural gas
Source of data used:	Producer of the natural gas
Value applied:	0.000725
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value obtained from state-owned gas company, PGN
Any comment:	N/A

Data / Parameter:	**EF**-diesel-CO_2
Data unit:	t-CO_2/TJ
Description:	CO_2 emission factor for diesel
Source of data used:	2006 IPCC Guidelines
Value applied:	74.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the 2006 IPCC Guidelines: Diesel Oil = 74,100kg-CO_2/TJ Therefore: **EF**-diesel-CO_2 = 74,100kg-CO_2/TJ / 10^3 = 74.1t-CO_2/TJ
Any comment:	N/A

Data / Parameter:	**Cal**-diesel
Data unit:	TJ/Gg
Description:	Calorific value of diesel
Source of data used:	2006 IPCC Guidelines
Value applied:	43.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from the 2006 IPCC Guidelines
Any comment:	N/A

Data / Parameter:	**Den**-diesel
Data unit:	kg/ℓ
Description:	Density of diesel
Source of data used:	State-owned oil company, PT. Pertamina
Value applied:	0.837
Justification of the choice of data or description of measurement methods and procedures actually applied:	Value obtained from state-owned oil company, PT. Pertamina
Any comment:	N/A

B.6.3 Ex-ante calculation of emission reductions:

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- **Calculation of emission reductions**

Emission reductions will be calculated based on formulae computed for the baseline.

$$\mathbf{ER}_{,y} = \mathbf{BE}_{,y} - \mathbf{PE}_{,y} - \mathbf{L}_{,y}$$
$$= 14{,}819 - 189 - 2{,}458$$
$$= 12{,}172 \text{ t-}CO_2\text{/yr}$$

Details on calculations for baseline emissions ($\mathbf{BE}_{,y}$), project emissions ($\mathbf{PE}_{,y}$), and leakage ($\mathbf{L}_{,y}$) are shown below.

- **Baseline emissions ($\mathbf{BE}_{,y}$)**

The amount of electricity produced by the cogeneration system will be used to calculate baseline emissions. At this stage, we do not expect to use natural gas for the project activity; therefore, $\mathbf{EG}_{,y} = \mathbf{EG}_{\text{-actual},y} = \mathbf{EG}_{\text{-system-biomass},y}$ and baseline emissions are reached using the following formula.

$$\mathbf{BE}_{,y} = \mathbf{EG}_{,y} \times \mathbf{EF}_{\text{-grid}}$$
$$= 16{,}632 \times 0.891$$
$$= 14{,}819 \text{ t-}CO_2\text{/yr}$$

Details on the Measurement of Baseline electricity production($\mathbf{EG}_{\text{-actual},y}$) and emission factor for the JAMALI grid ($\mathbf{EF}_{\text{-grid}}$) are given in Section B.7.1.

- **Specific fuel consumption for fuel *i* ($\mathbf{SFC}_{\text{-i}}$)**

Fuel *i* specific fuel consumption will be calculated using the following formula.

$\mathbf{SFC}_{\text{-i}} = \mathbf{Cp} / (\mathbf{Cal}_{\text{-i}} / 10^3)$	
$\mathbf{SFC}_{\text{-i}}$	Specific fuel consumption for fuel *i* (t-NG or t-biomass/MWh)
Cp	Calorific value required for electricity production (kcal/MWh)
$\mathbf{Cal}_{\text{-i}}$	Calorific value of fuel *i* used in the project activity (kcal/kg-biomass or kcal/kg-NG)

The specific fuel consumption for fuels that might be used ($\mathbf{SFC}_{\text{-i}}$) is as follows.

Renewable biomass	
Wood biomass	4,786,911 / (3,816 / 10^3) = 1.254t-biomass/MWh
Chaff	4,786,911 / (3,081 / 10^3) = 1.553t-biomass/MWh
Rice straw	4,786,911 / (3,368 / 10^3) = 1.421t-biomass/MWh
Coconut fiber	4,786,911 / (4,141 / 10^3) = 1.155t-biomass/MWh
Mushroom beds	4,786,911 / (2,242 / 10^3) = 2.135t-biomass/MWh
Fossil fuel	
Natural gas	4,786,911 / (11,465 / 10^3) = 0.417t-NG/MWh

Details on specific fuel consumption for fuel *i* ($\mathbf{SFC}_{\text{-i}}$), calorific value of fuel *i* used in the project activity ($\mathbf{Cal}_{\text{-i}}$), and calorific value required for electricity production (**Cp**) are given in Section B.6.2.

- **Project emissions (PE,y)**

Project emissions will be calculated using the following formula.

$$\mathbf{PE}_{,y} = \mathbf{EM}_{\text{-biomass,y}} + \mathbf{EM}_{\text{-grid,y}} + \mathbf{EM}_{\text{-diesel power plant,y}} + \mathbf{EM}_{\text{-loader,y}}$$
$$= 0 + 38 + 0 + 151$$
$$= 189 \ \text{t-}CO_2\text{/yr}$$

Shown below are details on calculations for emissions resulting from burning renewable biomass ($\mathbf{EM}_{\text{-biomass,y}}$), emissions resulting from importing electricity from the grid ($\mathbf{EM}_{\text{-grid,y}}$), emissions resulting from diesel generator operation ($\mathbf{EM}_{\text{-diesel power plant,y}}$), and emissions resulting from wheel loader operation ($\mathbf{EM}_{\text{-loader,y}}$).

- **Emissions resulting from burning renewable biomass ($\mathbf{EM}_{\text{-biomass,y}}$)**

Emissions resulting from the burning of renewable biomass can be considered to be 0t-CO_2/yr.

$$\mathbf{EM}_{\text{-biomass,y}} = 0\text{t-}CO_2\text{/yr}$$

- **Emissions resulting from importing electricity from the grid ($\mathbf{EM}_{\text{-grid,y}}$)**

$$\mathbf{EM}_{\text{-grid,y}} = \mathbf{EG}_{\text{-grid,y}} \times \mathbf{EF}_{\text{-grid}}$$
$$= 43 \times 0.891$$
$$= 38 \ \text{t-}CO_2\text{/yr}$$

The amount of electricity imported from the grid will be determined through monitoring. Boiler maintenance will be carried out once every two months following equipment installation. Details on electricity imported from the grid ($\mathbf{EG}_{\text{-grid,y}}$) are given in Section B.7.1.

- **Emissions resulting from diesel generator operation ($\mathbf{EM}_{\text{-diesel power plant,y}}$)**

$$\mathbf{EM}_{\text{-diesel power plant,y}} = \mathbf{PEC}_{\text{-diesel power plant,y}} \times \mathbf{EF}_{\text{-diesel-}CO_2} \times \mathbf{Cal}_{\text{-diesel}} \times \mathbf{Den}_{\text{-diesel}} /10^6$$
$$= 0 \times 74.1 \times 43.0 \times 0.837 /10^6$$
$$= 0\text{t-}CO_2\text{/yr}$$

The quantity of diesel consumed by the diesel generator ($\mathbf{PEC}_{\text{-diesel power plant,y}}$) will be determined through monitoring after implementing the project activity (See Section B.7.1. for details).

The CO_2 emission factor for diesel ($\mathbf{EF}_{\text{-diesel-}CO_2}$), calorific value of diesel ($\mathbf{Cal}_{\text{-diesel}}$), and density of diesel ($\mathbf{Den}_{\text{-diesel}}$) will be specified in advance (See Section B.6.2. for details).

- **Emissions resulting from wheel loader operation ($\mathbf{EM}_{\text{-loader,y}}$)**

$$\mathbf{EM}_{\text{-loader,y}} = \mathbf{PEC}_{\text{-fuel-loader for system,y}} \times \mathbf{EF}_{\text{-diesel-}CO_2} \times \mathbf{Cal}_{\text{-diesel}} \times \mathbf{Den}_{\text{-diesel}} /10^6$$
$$= 56{,}520 \times 74.1 \times 43.0 \times 0.837 / 10^6$$
$$= 151 \ \text{t-}CO_2\text{/yr}$$

The CO_2 emission factor for diesel ($\mathbf{EF}_{\text{-diesel-}CO_2}$), calorific value of diesel ($\mathbf{Cal}_{\text{-diesel}}$), and density of diesel ($\mathbf{Den}_{\text{-diesel}}$) will be specified in advance (See Section B.6.2. for details).

✓ **Quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system ($PEC_{\text{-fuel -loader for system,y}}$)**

$PEC_{\text{-fuel -loader for system,y}}$
$= PEC_{\text{-fuel-loader,y}} \times (PEC_{\text{-biomass,y}} / (PEC_{\text{-biomass,y}} + PEC_{\text{-material-PB,y}}))$
$= 180{,}000 \times (50{,}148 / (50{,}148 + 109{,}560))$
$= 56{,}520$ ℓ /yr

The total quantity of diesel consumed by all wheel loaders ($PEC_{\text{-fuel-loader,y}}$), quantity of renewable biomass consumed by the cogeneration system ($PEC_{\text{-biomass,y}}$), and quantity of wood biomass consumed as PB raw material ($PEC_{\text{-material-PB,y}}$) will be determined through monitoring (See Section B.7.1. for details).

➢ **Leakage ($L_{,y}$)**

The results of leakage calculations are as follows.

$L_{,y} = EM_{\text{-Tf-system,y}} + EM_{\text{-biomass competition,y}} + EM_{\text{-Tp-fuel,y}}$
$= 0 + 0 + 2{,}458$
$= 2{,}458$ t-CO_2/yr

- **Leakage resulting from transfer of equipment ($EM_{\text{-Tf-system,y}}$)**

$EM_{\text{-Tf-system,y}} = 0$ t-CO_2/yr

- **Leakage resulting from competing use of renewable biomass ($EM_{\text{-biomass competition,y}}$)**

$EM_{\text{-biomass competition,y}} = 0$ t-CO_2/yr

- **Leakage resulting from fuel delivery ($EM_{\text{-Tp-fuel,y}}$)**

$EM_{\text{-Tp-fuel,y}}$
$= (PEC_{\text{-Tp-fuel-biomass,y}} + PEC_{\text{-Tp-fuel-loader,y}}) \times EF_{\text{-diesel-}CO_2} \times Cal_{\text{-diesel}} \times Den_{\text{-diesel}} / 10^6$
$= (921{,}600 + 236) \times 74.1 \times 43.0 \times 0.837 / 10^6$
$= 2{,}458$ t-CO_2/yr

The quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system ($PEC_{\text{-Tp-fuel-biomass,y}}$) and quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system ($PEC_{\text{-Tp-fuel-loader,y}}$) will be ascertained using the calculations shown below. All other values will be specified in advance (See Section B.6.2. for details).

- ✓ **Quantity of diesel consumed by trucks transporting renewable biomass for the cogeneration system ($PEC_{\text{-Tp-fuel-biomass,y}}$)**

$PEC_{\text{-Tp-fuel-biomass,y}}$
$= (PEC_{\text{-biomass-outside,y}} + (PEC_{\text{-biomass-outside,y}} \times PWC_{\text{-biomass}})) / ATp_{\text{-biomass}} \times D_{\text{-biomass}} / M_{\text{-biomass}}$
$= (46{,}080 + (46{,}080 \times 100\%)) / 5 \times 250 / 5$
$= 921{,}600$ ℓ /yr

Fixed values will be used for the average load of a renewable biomass collection truck ($ATp_{\text{-biomass}}$), average distance travelled by a renewable biomass collection truck ($D_{\text{-biomass}}$), renewable biomass collection truck mileage ($M_{\text{-biomass}}$), and renewable biomass moisture content ($PWC_{\text{-biomass}}$) for this project activity as the margin of error for the duration of the project is small and the effect on GHG emissions is slight.

The quantity of renewable biomass used by the cogeneration system obtained outside the project boundary ($PEC_{\text{-biomass-outside,y}}$) will be calculated using the formula below.

- **Quantity of renewable biomass used by the cogeneration system obtained outside the project boundary ($PEC_{\text{-biomass-outside,y}}$)**

$PEC_{\text{-biomass-outside,y}} = PEC_{\text{-biomass,y}} - PEC_{\text{-biomass-inside,y}}$
$= 50{,}148 - 4{,}068$
$= 46{,}080$

The quantity of renewable biomass consumed by the cogeneration system ($PEC_{\text{-biomass,y}}$) and quantity of renewable biomass used by the cogeneration system obtained within the project boundary ($PEC_{\text{-biomass-inside,y}}$) will be determined through monitoring (See Section B.7.1. for details).

- ✓ **Quantity of diesel consumed by tank trucks transporting fuel for wheel loaders that transport/feed renewable biomass to the cogeneration system ($PEC_{\text{-Tp-fuel-loade,y}}$)**

$PEC_{\text{-Tp-fuel-loade,y}} = PEC_{\text{-fuel-loader for system,y}} / ATp_{\text{-diesel}} \times D_{\text{-diesel}} / M_{\text{-diesel}}$
$= 56{,}520 / 16{,}000 \times 200 / 3$
$= 236$ ℓ /yr

The quantity of diesel consumed by wheel loaders for transporting/feeding renewable biomass to the cogeneration system ($PEC_{\text{-fuel-loader for system,y}}$) are as indicated in earlier calculations.

Fixed values will be used for the average load of a diesel delivery truck ($ATp_{\text{-diesel}}$), distance travelled by a diesel delivery truck ($D_{\text{-diesel}}$), and diesel delivery truck mileage ($M_{\text{-diesel}}$) for this project activity as the margin of error for the duration of the project is small and the effect on GHG emissions is slight.

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

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Table 9 shows emission reductions in the first crediting period, based on advance calculations.

Table 9 Estimated GHG emission reductions in the first crediting period

Year	Estimation of baseline emissions ($t\text{-}CO_2$)	Estimation of project activity emissions ($t\text{-}CO_2$)	Estimation of leakage ($t\text{-}CO_2$)	Estimation of overall emission reductions ($t\text{-}CO_2$)
2011	14,819	189	2,458	12,172
2012	14,819	189	2,458	12,172
2013	14,819	189	2,458	12,172
2014	14,819	189	2,458	12,172
2015	14,819	189	2,458	12,172
2016	14,819	189	2,458	12,172
2017	14,819	189	2,458	12,172
TOTAL	**103,733**	**1,323**	**17,206**	**85,204**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EF**-grid
Data unit:	$t\text{-}CO_2/MWh$
Description:	Emission factor for the JAMALI grid
Source of data to be used:	Website of Indonesia's DNA
Value of data:	0.891
Description of measurement methods and procedures to be applied:	An emission factor for the JAMALI grid (**EF**-grid) has been approved by Indonesia's State Ministry of Environment. The same emission factor, 0.891t-CO_2/MWh, will be applied to this project activity. (Annex3(1), Indonesia's DNA website: http://dna-cdm.menlh.go.id/id/database/) The emission factor will be recalculated after the end of each year based on data provided by Indonesia's State Ministry of Environment.
QA/QC procedures to be applied:	According to information provided by Indonesia's DNA
Any comment:	N/A

Data / Parameter:	$\mathbf{EG}_{\text{-actual,y}}$
Data unit:	MWh/yr
Description:	Baseline electricity production
Source of data to be used:	Monitoring by KTI
Value of data:	16,632
Description of measurement methods and procedures to be applied:	The actual amount of electricity produced using the new equipment will be recorded with a dedicated power generation monitor. The PB plant commenced commercial production in January 2008. Output began to increase and approximately 2.1MWh of electricity was required in the period from May to November 2008, in which output exceeded 6,000m^3/month. Multiplying this by daily hours of operation (24 hours) and the annual number of operating days (330) gives an annual electricity requirement of 16,632MWh/yr. $\mathbf{EG}_{\text{-actual,y}}$ = 2.1MW × 24hr/year × 330day/year = 16,632MWh/yr * Actual energy requirement May: 1,335MWh/month June: 1,353MWh/month July: 1,593MWh/month August: 1,606MWh/month September: 1,357MWh/month October: 1,206MWh/month November: 1,113MWh/month **Ave. 1,366MWh/month** Therefore, the electricity requirement based on current figures is: 1,366(MWh/month) / 27(day/month)/ 24(hr/day) = 2.1MW
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	$\mathbf{PEC}_{\text{-NG,y}}$
Data unit:	Nm^3 /yr
Description:	Quantity of natural gas consumed
Source of data to be used:	Monitoring by KTI
Value of data:	0
Description of measurement methods and procedures to be applied:	At this stage, natural gas is not expected to be used; therefore, 0 Nm^3/yr will be the value applied to advance calculations. If natural gas is used, data will be monitored using a gas flow meter and introduced to the equation with 0.000725t-NG/Nm^3 assigned as the density of natural gas (see Section B.6.2. for details) and a unit adjustment being made.

QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**-biomass-i,y
Data unit:	t-biomass/yr
Description:	Quantity of renewable biomass *i* consumed
Source of data to be used:	Monitoring by KTI
Value of data:	Wood biomass: 42,876t-biomass/yr Chaff: 7,272t-biomass/yr Total: 50,148t-biomass/yr
Description of measurement methods and procedures to be applied:	At this stage, we plan to generate electricity using wood biomass and chaff. Other types of renewable biomass might also be used, however, and consumption will be monitored for each type. Records will consist of a log of the number of deliveries by wheel loader of each biomass type and a cross check involving a "calculation of actual usage." * "Calculation of actual usage" = Previous month-end inventory + Inventory received – Month-end inventory Electricity diverted for PB plant operation and electricity used for the power generation facility totals 3.0MW (2.1MW + 0.9MW). The energy required to produce 3.0MW of electricity and 7.0 tons of steam is 23,482,833kcal/hr. Therefore, the annual energy requirement is: 23,482,833(kcal/hr) × 330(day) × 24(hr) = 185,984,037,360kcal/yr. The quantity of wood biomass required is then reached by performing the following calculation, assigning 3,816kcal/kg as the calorific value of wood biomass: 185,984,037,360 (kcal/yr) / 3,816(kcal/kg) / 10^3 = 48,738 t-biomass/yr The amount of wood biomass available annually is 42,876 tons, meaning the 5,862t-biomass/yr shortage must be filled by another type of biomass. At this stage, we plan to use chaff, whose availability is stable throughout the year. If chaff is used to fill a shortage of wood biomass, it will be the equivalent of 606t-biomass/month, making the total 7,272t-biomass/year(from Annex3(2)).
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**EG**-grid,y
Data unit:	MWh/yr
Description:	Electricity imported from the grid
Source of data to be used:	Monitoring by KTI
Value of data:	43
Description of measurement methods and procedures to be applied:	The amount will be recorded using a dedicated power generation monitor. Operations will be halted at the facility about six times a year to perform maintenance. Electricity from PLN will be needed following maintenance to restart the equipment. Each restart will take approximately eight hours and the equipment will require 0.9MW of electricity; therefore, the amount imported from the grid annually for restarting the equipment is calculated as follows. 0.9MW × 8hr/restart × 6 restarts/yr = 43MWh/yr Besides restarting after maintenance, electricity imported from PLN in emergencies and at other times will be calculated as electricity imported from the grid.
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**-diesel power plant,y
Data unit:	ℓ /yr
Description:	Quantity of diesel consumed by the diesel generator
Source of data to be used:	Monitoring by KTI
Value of data:	0
Description of measurement methods and procedures to be applied:	The quantity will be recorded using a dedicated power generation monitor. The diesel-powered generator will be used mainly in emergencies. As frequency of use and other parameters cannot be accurately ascertained, the value shall be 0 liters/yr for calculation purposes.
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**- fuel-loader,y
Data unit:	ℓ /yr
Description:	Total quantity of diesel consumed by all wheel loaders
Source of data to be used:	Monitoring by KTI
Value of data:	180,000
Description of measurement methods and procedures to be applied:	The quantity will be recorded by checking the diesel tank level and using a flow meter during supply. The PB plant currently has two wheel loaders. The fuel consumption of two wheel loaders is approximately 10,000 liters/month. Annual consumption for two wheel loaders is therefore 10,000 liters/month × 12 months = 120,000 liters/yr, or approximately 60,000 liters/yr per loader. Assuming from the above that the wheel loader scheduled to be newly acquired will also consume 60,000 liters/yr, the three loaders will be expected to consume a total of 180,000 liters/yr.
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**-biomass,y
Data unit:	t-biomass/yr
Description:	Quantity of renewable biomass consumed by the cogeneration system
Source of data to be used:	Monitoring by KTI
Value of data:	50,146
Description of measurement methods and procedures to be applied:	This is the sum of the quantities of wood biomass and chaff used. It is the same value as the quantity of renewable biomass *i* consumed (**PEC-**biomass-i,y).
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**-material-PB,y
Data unit:	t-biomass/yr
Description:	Quantity of wood biomass consumed as PB raw material
Source of data to be used:	Monitoring by KTI
Value of data:	109,560
Description of measurement methods and procedures to be applied:	The quantity is recorded using the same methods as for the quantity of renewable biomass *i* consumed (**PEC**-biomass-i,y). When the PB plant is producing at a maximum capacity of 11,000m^3/month, the wood biomass consumption is 9,130t-biomass/month.

	Therefore, **PEC**-material-PB,y = 9,130t-biomass × 12 month = 109,560t-biomass/yr
QA/QC procedures to be applied:	Instrument accuracy will be monitored according to the ISO 9001 standard for management systems.
Any comment:	N/A

Data / Parameter:	**PEC**-biomass-inside,y
Data unit:	t-biomass/yr
Description:	Quantity of renewable biomass used by the cogeneration system obtained within the project boundary
Source of data to be used:	Monitoring by KTI
Value of data:	4,068
Description of measurement methods and procedures to be applied:	Under this project activity a priority will be given to using wood biomass generated by the plant.KTI will monitor how much of the wood biomass generated each month by the KTI plant is utilized by the cogeneration system. The introduction of equipment is being considered for the Probolinggo Plant. The results of a survey on availability show that wood biomass generated by the plant(within the project boundary) is 339t-biomass/month; therefore, 4,068t-biomass/year generated by the plant will be available for use, and there will be no need to purchase that quantity from outside the project boundary. The outcome of the calculation is as follows: **PEC**-biomass-inside,y = 339 (t-biomass/month) × 12 (month) = 4,068 t-biomass/yr
QA/QC procedures to be applied:	
Any comment:	N/A

B.7.2 Description of the monitoring plan:

>>

KTI has already acquired ISO 9001 certification for its plywood/building materials plants. Certification of the PB plant is expected in 2009, which means the plant will be certified before project implementation. Therefore, controls will be upheld through the monitoring frameworks described in ISO procedures. The requirement that calibration of measuring equipment be performed once a year will be included in the procedures.

The PB Production Division will tabulate parameters such as production cost and electricity usage for the PB plant at the end of each month and file a monthly report that the general manager of the Administration Division will confirm and deliver to the company president. Reporting for this project activity will follow the same format.

With implementation of the project activity, a Biomass Power Plant Section (hereinafter, "BPP Section") will be newly established within the PB Production Division. Data on electricity production by the biomass power generation facility, electricity supplied by PLN, and electricity supplied by emergency diesel generators will be obtained using a dedicated power generation monitor. The BPP Section will record the data.

The PB plant's management systems can be applied to the following monitoring parameters for biomass power generation:

- Renewable biomass inputs (record of the number of deliveries by wheel loader of each type of renewable biomass and cross check involving a "calculation of actual usage")
  * "Calculation of actual usage":
    = Previous month-end inventory + Inventory received – Month-end inventory
- Quantity of renewable biomass collected (recorded using truck scales)
  * To ascertain the dry weight of renewable biomass, a portion of the biomass collected by truck will be sampled in order to check the moisture content. The moisture content used to calculate leakage resulting from fuel delivery will be fixed in advance at 100% for simplification purposes as the value would otherwise be obtained from actual measurements of the volume (dry weight) of renewable biomass.
  * With regard to competing uses of renewable biomass, it will be confirmed each year that 25% or more of the quantity of renewable biomass used in the project activity will be available in surplus. (Attachment C to Appendix B, EB28)
- Diesel consumption (recorded through monitoring of the diesel tank level and use of a flow meter during supply)
  With regard to natural gas consumption, a meter is scheduled for installation when the cogeneration system is installed.

The BPP Section will use data reported at the end of each month to compute GHG emission reductions. The management structure relating to this project activity is detailed in Fig. 4.

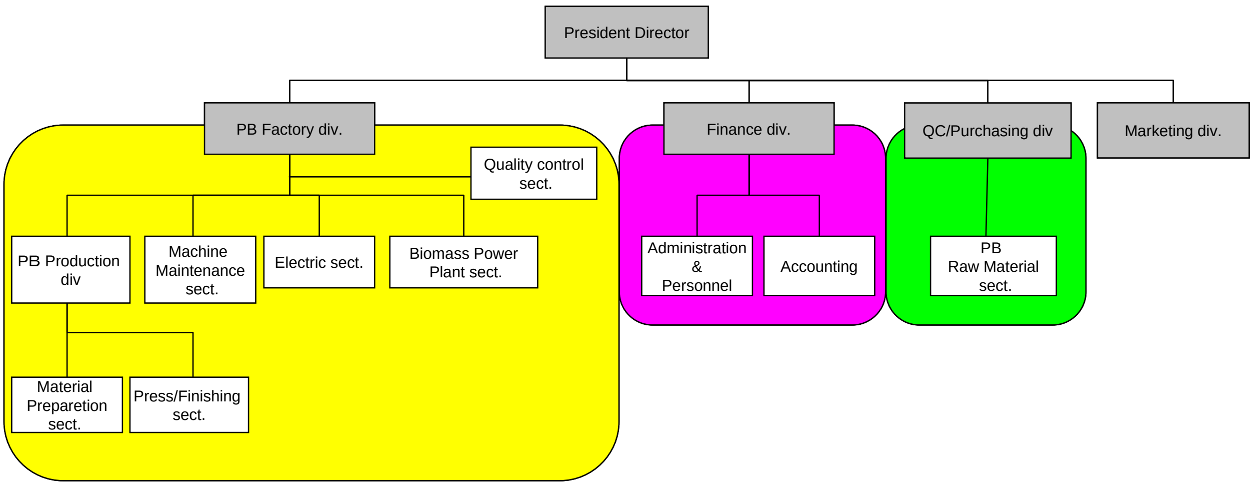

Fig. 4 Management Structure

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

>>

Methodology to be applied to this project activity was finalized on December 15, 2008. The persons to contact concerning methodology are as follows.

1. Atsushi Ikeda

Sumitomo Forestry Co., Ltd.
Marunouchi Trust Tower North (16th floor), 1-8-1, Marunouchi, Chiyoda-ku, Tokyo, JAPAN 100-8270
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2. Yasuhiro Yokoyama

Sumitomo Forestry Co., Ltd.
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E-mail: YOKOYAMA_yasuhiro@star.sfc.co.jp

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
July 2010

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

>>
Over 20 years

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

C.2.1. Renewable crediting period

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

>>
January 2011

C.2.1.2. Length of the first crediting period:

>>
Seven years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

The State Ministry of Environment Decree No.11/2006 states that biomass power generation facilities with capacity of 10MW or greater are considered to be in a business category to which the AMDAL method of environmental impact assessment shall be applied. The cogeneration system to be installed through this project activity will have a capacity of 4.5MW and therefore AMDAL is not required. Instead of AMDAL, KTI will executes this project based on Environmental management and observation documents (DPPL).

The results of surveys of the following DPPL criteria are to be submitted to Probolinggo City twice yearly.

- Air pollution
- Noise
- Vibration
- Water pollution
- Flood prevention
- Soil contamination
- Harmful substances
- Health of employees and local residents

Since the project activity will make use of renewable biomass, greater reductions of particulate matter and carbon monoxide emissions are achievable when compared to the utilization of fossil fuels.

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

>>

There are no significant environmental impacts not covered in section D.1.

SECTION E. Stakeholders' comments

>>

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

>>

As the project activity is still in the survey stage, we are unable to hold an official stakeholders meeting. We have paid visits to the following stakeholders, however, in order to explain the current status of the project and to listen to their views.

- Biomass suppliers
- Life & Environment Division, Probolinggo Municipal Government
- State-owned gas company (PT. PGN)
- State-owned electricity company (PT. PLN)
- Climate Change Division, State Ministry of Environment

- **Biomass suppliers**

We visited and gathered information from four companies that supply wood waste and chaff—types of biomass of which there is a stable supply. Prices for chaff differ according to the time of year, and are lowest from March to May when there is a surplus. Some agricultural waste is currently not collected and could be collected through a collection company.

- **Life & Environment Division, Probolinggo Municipal Government**

KTI's biomass power generation project will increase the income of local residents and contribute to the local economy. Probolinggo's Life & Environment Division will thus be able to offer support.

- **State-owned gas company (PT. PGN)**

PGN plans to raise the capacity of its gas supply and expects to be able to supply gas to KTI by April 2011. The company's policy is to provide gas at a cheaper per-calorie rate than diesel.

- **State-owned electricity company (PT. PLN)**

Other companies besides KTI are switching to captive power generation, which PLN does not interfere with. PLN wishes to purchase any surplus electricity generated.

PLN has a plan to raise its electricity generation capacity to 10,000MW by 2011. Electricity prices will likely rise to 900-1,300Rp/kWh in the future.

- **Climate Change Change, State Ministry of Environment**

KTI's project activity is not expected to be subject to domestic laws and regulations in Indonesia and may therefore proceed as a CDM project.

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

>>

No account is necessary.

- - - - -

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Sumitomo Forestry Co., Ltd.	
Street/P.O.Box:	1-8-1, Marunouchi	
Building:	Marunouchi Trust Tower North	
City:	Chiyoda-ku	
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Country:	Japan	
Telephone:	+81-3-6730-3520	
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E-Mail:		
URL:	http://sfc.jp/	
Represented by:		
Title:	Manager	
Salutation:		
Last Name:	Ikeda	Yokoyama
Middle Name:		
First Name:	Atsushi	Yasuhiro
Department:	Environmental Management Division	Environmental Management Division
Mobile:		
Direct FAX:		
Direct tel:		
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Building:		
City:	Pelabuhan Probolinggo	
State/Region:	Jawa Timur	
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Country:	Indonesia	
Telephone:	+62-335-422412	
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E-Mail:		
URL:	http://www.kti.co.id/	
Represented by:		
Title:	President Director	Mechanical Chief
Salutation:		
Last Name:	Yasuda	Pramudyasari
Middle Name:		
First Name:	Toshio	Angga
Department:		
Mobile:		

Direct FAX:		
Direct tel:		
Personal E-Mail:	ysd@sfc.co.jp	angga_pram@kti.co.id

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No official development assistance (ODA) or other source of funding has been recieved for this project.

Annex 3

BASELINE INFORMATION

(1)Information about Emission factor for the JAMALI grid

KEMENTERIAN NEGARA LINGKUNGAN HIDUP
REPUBLIK INDONESIA

Jl. D.I. Panjaitan, Kebon Nanas
JAKARTA 13410
Kotak Pos/PO Box 7777 JAT 13000

Telepon : 021-8580067-69, 8517148
Faksimil : 021-8518135, 8517147
Website : Http://www.menlh.go.id

Jakarta, 19 Januari 2009

Nomor : B-277/Dep.III/LH/01/2009
Lamp. : -
Perihal : Informasi terbaru baseline faktor emisi untuk proyek CDM pada sistem ketenagalistrikan Sumatera dan J JAMALI

Kepada Yth. :
(Daftar tujuan surat terlampir)
di
Tempat

Menindaklanjuti surat dari Direktur Jenderal Listrik dan Pemanfaatan Energi, Departemen Energi dan Sumber Daya Mineral (No: 37833/21/600.5/2008) tanggal 24 Desember 2008 perihal Baseline Faktor Emisi Sistem ketenagalistrikan Sumatera dan Updating baseline Faktor Emisi Sistem ketenagalistrikan JAMALI, maka bersama ini disampaikan bahwa informasi terbaru untuk baseline faktor emisi pada sistem ketenagalistrikan Sumatera dan JAMALI adalah sebagai berikut:

a. Sistem ketenagalistrikan Sumatera : **0,743 tCO_2 eq/MWH;**
b. Sistem ketenagalistrikan JAMALI : **0,891 tCO_2 eq/MWH**

Sehubungan dengan hal tersebut di atas, maka secara resmi informasi tersebut dapat digunakan oleh para pemangku kepentingan dalam mengembangkan proyek CDM di Indonesia.

Demikian kami sampaikan atas perhatiannya diucapkan terima kasih.

Deputi MENLH Bidang Peningkatan
Konservasi SDA dan Pengendalian
Kerusakan Lingkungan / Ketua KN-MPB,

KEMENTERIAN NEGARA LINGKUNGAN HIDUP * REPUBLIK INDONESIA *

Dra. Masnellyarti Hilman, MSc.

Tembusan Yth.:
- Menteri Negara LH (sebagai laporan)

(2)Renewable biomass availability

The amount of renewable biomass required for the project activity, in terms of wood biomass volume, is 48,738t-biomass/yr. A reliable framework for collecting renewable biomass is essential for implementing the project activity. In the dry season, however, sugar mills and brick factories in the surrounding region consume large volumes of wood biomass as their manufacturing reaches a peak period, generating competition over access to wood biomass. Therefore, we decided to consider the use of other types of renewable biomass besides wood.

As the volume of renewable biomass available varies according to the time of year, it was necessary to ascertain the amount available throughout the year. Additionally, we needed to demonstrate that at least 25% of the quantity of renewable biomass used in the project activity will be available in surplus, as stipulated in rules on leakage.

- **Scope of survey (scope of biomass collection)**

A total of 132 companies (plants and farms, for example) within a 250km radius of the KTI plant were surveyed.

Districts surveyed and their distances from the KTI plant are shown in Table 10.

Table 10 Districts surveyed and distances from plant

District	Distance from plant (km)
Probolinggo	0-50
Lumajang	50
Pasuruan	50
Sidoarjo	80
Malang	100
Mojokerto	100
Situbondo	100
Jember	100
Bondowoso	100
Gresik	130
Lamongan	150
Banyuwangi	200
Nganjuk	200
Madiun	250
Average distance from plant	124

Note: The average distance from the plant was calculated as a weighted average omitting Probolinggo, where the plant is located.

- **Survey method**

Questionnaires were distributed and hearings conducted during visits to sites to be surveyed.

➢ **Survey results**

Types of available renewable biomass are listed in Table 11 below.

Table 11 Types of renewable biomass available for use in the project activity

Renewable biomass	
Wood biomass (timber offcuts, sawdust, etc.)	
Agricultural waste	
Rice straw	Chaff
Coconut fiber	Mushroom beds

The volume of agricultural waste available varies according to the time of year. However, a reliable framework for collecting renewable biomass is necessary for implementing the project activity. Through the questionnaires and hearings carried out at the 132 plants and farms, we were able to tabulate data received relating to the volume of biomass generated throughout the year. The data confirmed that a stable quantity is generated each month, even though the amount varies from month to month, and that the amount of renewable biomass available for supply to KTI would be 16,373t-biomass/month (See Table 12).

Table 12 Availability by district (t-biomass/month)

District	Wood biomass		Agricultural waste			
	Purchased	Generated	Chaff	Rice straw	Coconut fiber	Mushroom beds
Probolinggo	1,655	339	—	—	—	—
Lumajang	1,454	125	—	—	1	—
Pasuruan	—	—	109	562	—	—
Sidoarjo	—	—	—	—	—	—
Malang	—	—	—	—	—	—
Mojokerto	—	—	—	—	—	400
Situbondo	—	—	—	—	—	—
Jember	—	—	—	—	—	—
Bondowoso	—	—	—	—	—	—
Gresik	—	—	545	1,385	—	—
Lamongan	—	—	1,364	3,462	—	—
Banyuwangi	—	—	—	—	—	—
Nganjuk	—	—	818	4,154	—	—
Madiun	—	—	—	—	—	—
Sub-total (wood biomass)	3,109	464	—	—	—	—
Availability by type	3,573		2,836	9,563	1	400
TOTAL (dry weight)	**16,373**					

Wood biomass will be the main fuel used for the project activity. The new equipment to be installed at KTI will require 4,062 tons of wood biomass a month (48,738t-biomass/yr ÷ 12 months). Table 12 indicates that the amount of wood biomass available is 3,573 tons/month, meaning a shortage of 489t-biomass/month. We plan to fill this shortage using chaff, available in stable quantities. To produce the same amount of heat as would be produced by 489 tons of wood biomass, 606 tons of chaff are required. The survey concluded the available biomass would be sufficient (See Note 1 below for details). The amount of biomass fed into the boilers in such a scenario would be 4,179tons/month.

The total amount of renewable biomass available is 16,373 tons/month. Enough renewable biomass is therefore available to collect for use in power generation.

(Note 1)

- Calorific value of wood biomass: 3,816kcal/kg-biomass (measured)
- Calorific value of chaff: 3,081kcal/kg-biomass (measured)

Accordingly, (calorific value of wood biomass) ÷ (calorific value of chaff) = 1.239

Therefore, the amount of chaff required to make up for the 489 tons/month shortage of wood biomass can be reached using the following formula:

Wood biomass shortage (489t-biomass/month) × 1.239 = 606t-biomass

■ **Leakage resulting from competing use of renewable biomass**

When collecting renewable biomass, it is necessary to demonstrate that an amount equivalent to 25% of the amount used in the project activity will be available in surplus. If this cannot be demonstrated, it will be inferred that firms already using renewable biomass will have to switch to fossil fuels or other forms of energy. Leakage would need to be calculated in such a scenario. (AttachmentC to Appendix B, EB28 General guidance on leakage in biomass project activities (version02))

The amount of renewable biomass available to KTI in stable supply each month is 16,373 tons. Assuming the heat released by renewable biomass used in the project activity was 2,242kcal/kg-biomass (Note 2), each month 6,913t-biomass would need to be collected.

In that scenario, 9,460t-biomass/month would be available in surplus, equivalent to 137% of the amount used in the project activity; therefore, the surplus requirement of 25% of the amount used in the project activity would be comfortably met.

From the above, we can conclude there is no need to take into account leakage resulting from competing use of renewable biomass.

(Note 2)

This is the calorific value of mushroom beds, the lowest calorific value observed in the study. Although mushroom beds will not be used as fuel, this value was applied to ascertain the maximum amount of renewable biomass.

<u>Annex 4</u>

MONITORING INFORMATION

No further information needs to be listed here beyond that given in Section B.7.

Annex 5

IRR CALCULATION

Calculation for Project Feasibility Study at PT. KTI

Renewable Biomass Captive Power Generation Project —Alternative Facilities		
Electricity generation capacity	4.5	MW
Thermal generation capacity	6.5	MW_{th}
Annual electricity consumption	16,632	MWh/year
Electricity usage in manufacturing	2.1	MW
Electricity consumption in power generation	0.875	MW
Total electricity production	2.98	MW
Steam production (employing heat)	55,440	t-steam/year
Ash emission rate	1.5	% of fuel
Ash disposal expenses	10	US$/ton
CO_2 reductions	12,172	ton/year
Project activity energy requirement	185,984,037	Mcal/year

discount % 0%

Biomass fuel type		Unit price (Rp/wet-kg)	Unit price ($/ton)	Unit price (Rp/dry-kg)	Calorific value (kcal/kg-biomass)	Consumption (dry-ton/year)	Energy generation (Gcal)
- Wood biomass	Purchased	180	18	342	3,816	37,308	142,367
	Generated in own plants	135	13.5	257	3,816	5,568	21,247
Other types of renewable biomass							
- Chaff		250	25	275	3,081	7,272	22,405
- Rice straw		100	10	130	3,368	0	0
- Coconut fiber		250	25	425	4,141	0	0
- Mushroom beds		150	15	450	2,242	0	0
		Energy shortage					0
		Total project activity calorie requirement (calories					185,984

Investment (US$) 8,200,000
(Power generation equipment + gas supply infrastructure)

Subject		year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
No. of operating days		(days/year)		330	330	330	330	330	330	330	330	330
Electricity imported from grid (before activity implementation)		MWh		16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632
Electricity imported from grid (after activity implementation)		MWh	50	50	50	50	50	50	50	50	50	50
Reduction in electricity imported from grid				16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582
Annual CO_2 reduction (tons/year)				12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172
Credit price (US$/ton)			0.0	0.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Purchase price of electricity from grid (US$/MWh)		112 US$/MWh 3% (Annual % price increase)	112	115	119	122	126	130	134	138	138	138
Price of diesel oil (US$/liter)		0.5 US$/l 5% (Annual % price increase)	0.50	0.53	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78
Price of natural gas (US$/$Nm^3$)		0.2 US/Nm^3 3% (Annual % price increase)	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.25	0.25	0.26
Wood biomass purchasing costs (US$/ton)		1,275,933 US$	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031
Chaff purchasing costs (US$/ton)		199,980 US$	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980
Rice straw purchasing costs(US$/ton)		1% (Annual % price increase)	0	0	0	0	0	0	0	0	0	0
Coconut fiber purchasing costs(US$/ton)		1% (Annual % price increase)	0	0	0	0	0	0	0	0	0	0
Mushroom beds purchasing costs(US$/ton)		1% (Annual % price increase)	0	0	0	0	0	0	0	0	0	0
Estimated exchange rate (Rp./US$)		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Gains	Cost reductions from decrease in electricity imported from grid (US$/year)		0	1,912,900	1,970,290	2,029,405	2,090,294	2,153,007	2,217,594	2,284,121	2,284,121	2,284,121
	Revenue from credits		0	0	243,440	243,440	243,440	243,440	243,440	243,440	243,440	243,440
Expenses	Biomass purchasing costs for power generation (US$/year)			1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011
	CDM project expenses (US$)		100,000	100,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	Ash disposal expenses (US$/year)				6,687	6,687	6,687	6,687	6,687	6,687	6,687	6,687
	Natural gas consumption expenses (US$/year)	0 Nm^3		0	0	0	0	0	0	0	0	0
	Diesel oil consumption expenses (US$/year)	60,000 liter		31,500	33,060	34,740	36,480	38,280	40,200	42,240	44,340	46,560
	Depreciation (US$)		0	0	0	0	0	0	0	0	0	0
	SG&A expenses (US$)	0.5%		41,000	41,205	41,411	41,618	41,826	42,035	42,245	42,456	42,668
	Labor expenses (US$)	24 persons 200 US$ 12 months 5.0% (Labor expenses % increase)		57,600	60,480	63,504	66,679	70,013	73,514	77,190	81,050	85,103
	Insurance (US$)	0.3%		24,600	24,674	24,748	24,822	24,896	24,971	25,046	25,121	25,196
	Corporation taxes (US$) (with CER)			0	0	0	0	0	0	0	0	0
	Corporation taxes (US$) (without CER)			0	0	0	0	0	0	0	0	0
Investment for CDM project (US$)		-8,200,000	(8,200,000)									
Gains from biomass power generation each FY (incl. CDM project establishment costs; US$)			(100,000)	39,189	398,613	452,744	508,437	565,734	624,616	685,142	678,896	672,336
Total profit from project activity (incl. CDM project establishment costs; US$)			(100,000)	(60,811)	337,801	790,545	1,298,982	1,864,716	2,489,331	3,174,473	3,853,369	4,525,705
Investment recovery period (incl. CDM project establishment costs; US$)		23 years 6 months	(8,300,000)	(8,534,711)	(8,417,744)	(8,242,786)	(8,006,361)	(7,704,837)	(7,334,482)	(6,891,378)	(6,439,897)	(5,980,078)
Unit cost of biomass power generation (incl. CDM project establishment costs; US$/kWh)				0.129	0.119	0.122	0.126	0.129	0.133	0.137	0.137	0.137
IRR (witl (with CER)		1.9%	(8,300,000)	39,189	398,613	452,744	508,437	565,734	624,616	685,142	678,896	672,336
Gains from biomass power generation each FY (excl. CDM project establishment costs; US$)			0	139,189	185,173	239,304	294,997	352,294	411,176	471,702	465,456	458,896
Total profit from the project activity (excl. CDM project establishment costs; US$)			0	139,189	324,361	563,665	858,662	1,210,956	1,622,131	2,093,833	2,559,289	3,018,185
Investment recovery period (excl. CDM project establishment costs; US$)		32 years 9 months	(8,200,000)	(8,331,411)	(8,421,176)	(8,459,771)	(8,443,946)	(8,370,302)	(8,235,347)	(8,035,411)	(7,835,124)	(7,634,787)
Unit cost of biomass power generation (excl. CDM project establishment costs; US$/kWh)				0.121	0.122	0.122	0.124	0.127	0.131	0.135	0.135	0.135
IRR (without CER)		-2.1%	(8,200,000)	139,189	185,173	239,304	294,997	352,294	411,176	471,702	465,456	458,896
Depreciation (US$)		Depreciation period: 10 years		820,000	820,000	820,000	820,000	820,000	820,000	820,000	820,000	820,000

Subject		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. of operating days		330	330	330	330	330	330	330	330	330	330	330
Electricity imported from grid (before activity implementation)		16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632	16,632
Electricity imported from grid (after activity implementation)		50	50	50	50	50	50	50	50	50	50	50
Reduction in electricity imported from grid		16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582	16,582
Annual CO_2 reduction (tons/year)		12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172	12,172
Credit price (US$/ton)		20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Purchase price of electricity from grid (US$/MWh)		138	138	138	138	138	138	138	138	138	138	138
Price of diesel oil (US$/liter)		0.82	0.86	0.90	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Price of natural gas (US$/$Nm^3$)		0.27	0.28	0.29	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36
Wood biomass purchasing costs (US$/ton)		1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031	1,419,031
Chaff purchasing costs (US$/ton)		199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980	199,980
Rice straw purchasing costs(US$/ton)		0	0	0	0	0	0	0	0	0	0	0
Coconut fiber purchasing costs(US$/ton)		0	0	0	0	0	0	0	0	0	0	0
Mushroom beds purchasing costs(US$/ton)		0	0	0	0	0	0	0	0	0	0	0
Estimated exchange rate (Rp./US$)		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Gains	Cost reductions from decrease in electricity imported from grid (US$/year)	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121	2,284,121
	Revenue from credits	243,440	243,440	243,440	243,440	243,440	243,440	243,440	243,440	243,440	243,440	243,440
Expenses	Biomass purchasing costs for power generation (US$/year)	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011	1,619,011
	CDM project expenses (US$)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	Ash disposal expenses (US$/year)	6,687	6,687	6,687	6,687	6,687	6,687	6,687	6,687	6,687	6,687	6,687
	Natural gas consumption expenses (US$/year)	0	0	0	0	0	0	0	0	0	0	0
	Diesel oil consumption expenses (US$/year)	48,900	51,360	53,940	56,640	56,640	56,640	56,640	56,640	56,640	56,640	56,640
	Depreciation (US$)	0	0	0	0	0	0	0	0	0	0	0
	SG&A expenses (US$)	42,881	43,095	43,310	43,527	43,745	43,964	44,184	44,405	44,627	44,850	45,074
	Labor expenses (US$)	89,358	93,826	98,517	103,443	108,615	114,046	119,748	125,735	132,022	138,623	145,554
	Insurance (US$)	25,272	25,348	25,424	25,500	25,577	25,654	25,731	25,808	25,885	25,963	26,041
	Corporation taxes (US$) (with CER)	0	142,902	143,934	144,883	146,590	148,258	149,883	151,460	152,983	154,446	155,844
	Corporation taxes (US$) (without CER)	0	102,874	106,912	103,827	108,715	113,743	118,912	121,750	119,775	117,704	115,534
Investment for CDM project (US$)												
Gains from biomass power generation each FY (incl. CDM project establishment costs; US$)		665,452	515,332	506,738	497,870	490,696	483,301	475,677	467,815	459,706	451,341	442,710
Total profit from project activity (incl. CDM project establishment costs; US$)		5,191,156	5,706,488	6,213,226	6,711,096	7,201,791	7,685,092	8,160,769	8,628,584	9,088,289	9,539,630	9,982,340
Investment recovery period (incl. CDM project establishment costs; US$)		(5,511,970)	(5,178,533)	(4,842,687)	(4,504,626)	(4,162,584)	(3,816,648)	(3,466,920)	(3,113,513)	(2,756,554)	(2,396,179)	(2,032,543)
Unit cost of biomass power generation (incl. CDM project establishment costs; US$/kWh)		0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137
IRR (witl (with CER)		665,452	515,332	506,738	497,870	490,696	483,301	475,677	467,815	459,706	451,341	442,710
Gains from biomass power generation each FY (excl. CDM project establishment costs; US$)		452,012	341,920	330,320	325,486	315,131	304,376	293,208	284,085	279,474	274,643	269,580
Total profit from the project activity (excl. CDM project establishment costs; US$)		3,470,196	3,812,116	4,142,436	4,467,922	4,783,052	5,087,428	5,380,636	5,664,721	5,944,194	6,218,837	6,488,417
Investment recovery period (excl. CDM project establishment costs; US$)		(7,434,724)	(7,338,150)	(7,249,989)	(7,163,753)	(7,085,027)	(7,014,457)	(6,952,726)	(6,898,081)	(6,846,245)	(6,797,528)	(6,752,266)
Unit cost of biomass power generation (excl. CDM project establishment costs; US$/kWh)		0.134	0.134	0.134	0.134	0.134	0.134	0.134	0.134	0.134	0.134	0.134
IRR (without CER)		452,012	341,920	330,320	325,486	315,131	304,376	293,208	284,085	279,474	274,643	269,580
Depreciation (US$)		820,000	0	0	0	0	0	0	0	0	0	0