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

CONTENTS

Annexes

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:

>>
4MW Biomass Power Plants Using Waste Wood Chips & Saw Dust in Central Java Province, Indonesia
Version 1.0
10/Jan/2007

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

>>
The project will be conducted by PT. Rimba Partikel Indonesia (hereinafter "PT.RPI") in the Kendal district, Central Java Province, Republic of Indonesia.
PT.RPI was founded in 1990 through the merger of companies based in Japan and Indonesia and has established a particle board plant in the Kendal district. This plant is the only large-scale particle board plant on the island of Java. (See Fig-1)

Fig-1: Full view of the plant

- Goals of the project activities

PT.RPI currently has four diesel-powered generators, each with an output of 1.2MW. Normally the company operates two generators at a time, for an output of about 2.4MW of power. The annual generation of power is about 19GWh. The power generated provides all of the electricity used in the plant and the facilities on the grounds, so there is no connection to the power grid, nor any need to purchase power from outside sources.
The project likewise will not be connected with the external power grid nor will power be purchased from outside sources.

The equipment introduced under this project will include Biomass power (2.4MW) supplied to the currently existing equipment and facilities, plus the power necessary for running the generators themselves (0.7MW). Consideration has also been given to avoidance of overloads, so the equipment introduced will have a power generation capacity of 4MW.
The project plans to use about 2,601 tons per month of a mixture consisting of undried wood waste (including offcuts), sawdust, and waste of veneer as fuel.

PT.RPI has suffered from a decline in profitability due to the steep rise in the price of petroleum products within Indonesia, which has compelled the company to consider using alternative forms of energy. From a strictly monetary point of view, power-generating coal boilers are advantageous, and were originally considered. The CDM Project, however, can earn credits and adopt power-generating wood biomass boilers, making them nearly as economical as coal-burning boilers, so PT.RPI has decided to consider introducing such wood biomass power generators.

- Reduction of greenhouse gases through project activities

By using wood biomass as an energy source, the project can reduce greenhouse gas (hereinafter “GHG”) emissions. In other words, the difference in GHG emissions between those under the CDM scheme and those that would have resulted from the use of power-generating coal boilers, as originally considered, can be counted as a reduction in emissions.

The existing diesel-powered generators will be operated as supplementary equipment during times when the CDM project equipment is undergoing inspection, if problems occur, or when there are shortages of wood biomass fuel. The wood biomass power generators will be operated 330 days a year, and during the remaining 35 days, when the generators undergo inspection and maintenance, the diesel-powered generators will be operated. This is no different if coal power generators had been introduced, so the use of diesel-powered generators during inspection and maintenance of wood biomass power generators would not affect calculations of reductions in emissions.

In the case of shortages in the supply of wood biomass, the diesel-powered generators will be operated, while monitoring the power generated, and the difference between those emissions and the baseline emissions will be factored into the calculations of emissions reductions.

Almost all of the wood biomass to be used as fuel will be collected from nearby sawmills, so the fuel consumed in transporting it in can be calculated as “leakage” using the weighted average of the distances to each region and the amount of load carried, times two for the distances the trucks have to travel, to arrive at the amount of fuel consumed, which can then be used in calculating GHG emissions. GHG emissions are also calculated for the fuel used in transporting the diesel oil used in the existing generators, wheel loader and for the fuel used in transporting coal as a baseline scenario fuel.

- Contribution of the project activities to sustainable development

Until the year 2000, the government of the Republic of Indonesia provided subsidies to reduce petroleum-related fuel prices, but the rising cost of crude oil put too much of a financial burden on the government, so it has reduced those subsidies, and since July 2005, the price of petroleum products has risen enormously.
Moreover, in 2004, Indonesia became a net importer of petroleum, so it has been hurrying to diversify its energy sources. The country has relatively abundant coal deposits, which can be used to generate power, so it can reduce its dependence on petroleum fuels in the short term.

For the country's long term energy policy, however, the Indonesian government has put forth the goals of reducing consumption of petroleum, while increasing consumption of natural gas, coal and biomass, nuclear, hydroelectric, solar, wind and other new energy sources and renewable energy. (The Fifth Presidential Decree of 2006 declared that the government of the Republic of Indonesia would increase its use of renewable energy.) Use of biomass as an energy source would contribute to economic sustainability, which is in accord with the policies of the country.

There are many sawmills in Central Java Province, and along the relatively large roads a survey by PT.RPI alone counted 431 sawmills. Almost all of the wood biomass to be used as a fuel in this project will be collected from these sawmills in the form of offcuts and sawdust.

In Central Java Province, the wood wastes are currently used as materials or fuels for brick- and tile-making, and other regional industries, but in this region, there are diverse sources of wood biomass (for example, the publicly owned farming (PT. Perkebunan Nusantara) and forestry corporations (Perhutani) that supply twigs and branches for local people), so demand puts no pressure on supply.

The 431 sawmills mentioned above produce a total of 46,148 tons/month of wood wastes. Of that, according to the results of a questionnaire survey of 121 of these sawmills, 58% or more of the wood wastes will be available to PT.RPI. Subtracting the 2,601 tons PT.RPI expects to use monthly still leaves about 52% of the wood wastes generated with no demand immediately available. (See Annex 3.)

Since petroleum prices have risen, wood biomass has been used as a fuel, and the amount of wood biomass discarded has been decreasing, but in the Wonosobo district in the mountains of Central Java Province, even now there are places where wood biomass is still going to waste.
Under the project, PT.RPI will continue to purchase wood waste, so it will provide increased profits and opportunities for employment to the local communities, including sawmills and transport businesses, thus contributing to economic sustainability through improved standards of living.

Furthermore, in contrast with the use of coal, the ashes emitted from the wood biomass boilers will have little impact on health and provide the possibility of material recycling, so the project can contribute to environmental sustainability. The Republic of Indonesia classifies ashes from coal burning as "hazardous waste" (also called B3 waste material), and requires that they must be disposed by companies specializing in such disposal.

A.3. Project participants:

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Table-1: 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 involve dwishes to beconsidered asproject participant (Yes/No)
Republic of Indonesia	Private entity PT.Rimba Partikel Indonesia	No
Japan	Private entity 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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PT.RPI is located at the private land for the factory at the eastern of Kendal district, Java Island. It is 30km west from Semarang city, the capitol city of the Central Java Province.

Source: http://www.lib.utexas.edu/maps/indonesia.html

A.4.1.1. Host Party(ies):

>>
The Republic of Indonesia

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

>>
Kendal District, Province of Central Java

A.4.1.3. City/Town/Community etc:

>>
Desa Mororejo, Kaliwungu

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

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PT.RPI is located at S 6°56'10.02", E 110°17'23.24" by the Global Positioning System.

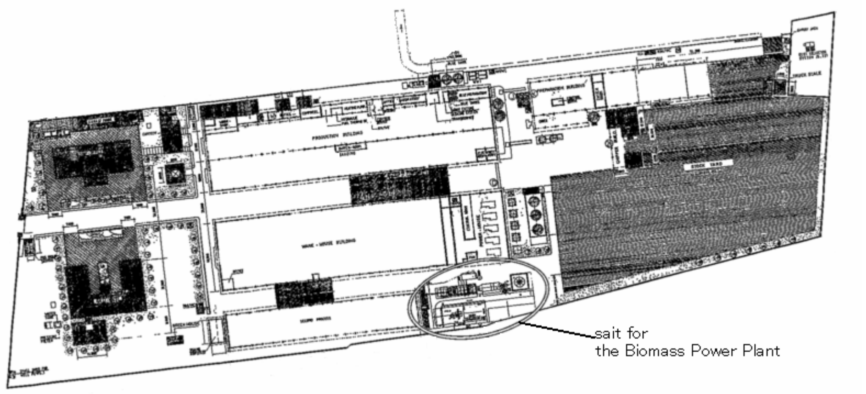

Fig-2: Layout of PT.RPI

About one kilometer north of the plant is the Java Sea. The plant is surrounded by ponds where fish (Bandeng) and shrimp are bred, and the nearest settlement, with a population of about 5,000, is approximately 500 meters away. The center of Kaliwungu County (population 91,783 as of January 2007) is located about seven kilometers from the plant.
This district is famous throughout Indonesia for the fish (Bandeng) raised there, which are mainly shipped fresh, but also vacuum packaged (with an expiry date of seven days) and transported to the major cities in Java. The annual production volume is about 1,200 tons.

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

>>
Type: TYPE (i)- Renewable Energy Projects (hereinafter referred to as "Type (i)")
Category: I.A. 'Electricity generation by the user' (hereinafter referred to as "Type (i)I.A.")
The project will utilize renewable energy with a maximum power generating capacity of 15MW or less, and it does not have connection with external power grids, and be used only by the users, so it qualifies as a small-scale CDM category, Type (i).A.
Fig-3 gives an outline of the equipment to be introduced. The project plans to use about 2,601 tons per month of a mixture consisting of undried wood wastes (offcuts and sawdust from sawmills as well as chipped lumber wastes and sawdust) as fuel. The boilers will have a steam generating capacity of 20 tons per hour, and a power generation capacity of 4MW, but plans call for 3.1MW to be actually generated.

The exhaust gases from the boilers will pass through a drop-out chamber, followed by an electrostatic precipitator, after which they will be released through a smokestack. This will eliminate fly ash from the exhaust gases, so the plan is expected to meet the atmospheric environmental standards stipulated in the country. For the equipment design, the electrostatic precipitator can reduce the density of the soot of from 3,000mg/m3 to 200mg/m3 or less. Environmental standards of soot emissions density in Indonesia is 350mg/m3. Therefore, environmental standards can be met.

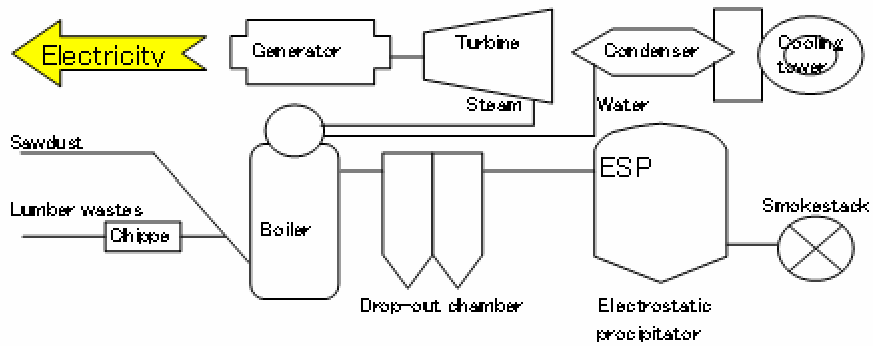

Fig-3: Project scheme

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

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Table-2: Estimation of annual emission reductions in the first crediting period

Year		Estimation of annual emission reductions in tonnes of CO_2e in the first crediting period
2008		33,308
2009		33,308
2010		33,308
2011		33,308
2012		33,308
2013		33,308
2014		33,308
Estimated reductions (tonnes of CO_2e)	Total	233,156
	Average	33,308

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

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There is no public funding involved in financing this project activities.

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

>> The project will be a CDM project through small-scale biomass power generation, with a maximum generating capacity of 15MW or less, utilizing renewable energy with no connection to external power grids, and it will be PT.RPI's first CDM project.The proposed project is not a debundled component of a large-scale project activities.

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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The project belongs to the following CDM project activities, as indicated in Appendix B for the Simplified Modalities and Procedures for Small –Scale CDM project activities.
Project type: Type (i) Renewable energy project
Project category: A. Electricity generation by the user/household
Also, AMS-1.A. (version 09) will be applied as a methodology.

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

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The project will use biomass as a substitute for fossil fuels (coal) with a maximum power generating capacity of 4MW and will be independent of the power grid, so it conforms to methodology AMS-1.A.

B.3. Description of the project boundary:

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Regarding the boundary of the project, “The physical, geographical site of the renewable energy generating unit and the equipment that used the electricity produced delineates the project boundary” of the methodology AMS-1.A to be applied. Fig-4 shows the boundary of the project.

Methodology AMS-1.A. specifies that leakage must be considered in the following circumstances.
“If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.”
The wood biomass power generators being introduced by the project activities will be newly built, and previously existing diesel-power generators will be maintained so that it can be used when necessary, and the generators are expected to be operated when the new equipment is undergoing inspections, so there will be no leakage resulting from transference of power generators.

However, concerns regarding increased GHG emissions resulting from the CDM project activities need to be studied beforehand, so the increased GHG emissions from consumption of fuel by vehicles transporting wood biomass for the project activities are considered as leakage.

There are many sawmills in the Central Java Province, and a survey by PT.RPI alone counted 431 sawmills along relatively large roads. These mills produce about 46,000 tons of wood waste per month, which is about 18 times the amount of fuel expected to be used in the project (2,601 tons per month). Almost all of the wood biomass to be used as a fuel in the project will be collected from these sawmills in the form of offcuts and sawdust.

Currently, the wood waste from these sawmills are mainly used by regional industries as materials or fuels for brick- and tile- making. In the Central Java Province, there are diverse sources of wood biomass in addition to offcuts and sawdust from sawmills (for example, old fruit or rubber trees discarded by publicly owned farming corporations, and twigs and branches from publicly owned forestry corporations), so demand puts no pressure on supply, and it is thought that there is no need to take into account leakage resulting from a tight supply and demand situation by using biomass which would have been used elsewhere. (For details on our survey, see Annex 3.) Therefore, it is not necessary to consider the leakage resulting from a tight supply and demand situation which is mentioned in Attachment C to Appendix B of indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories.

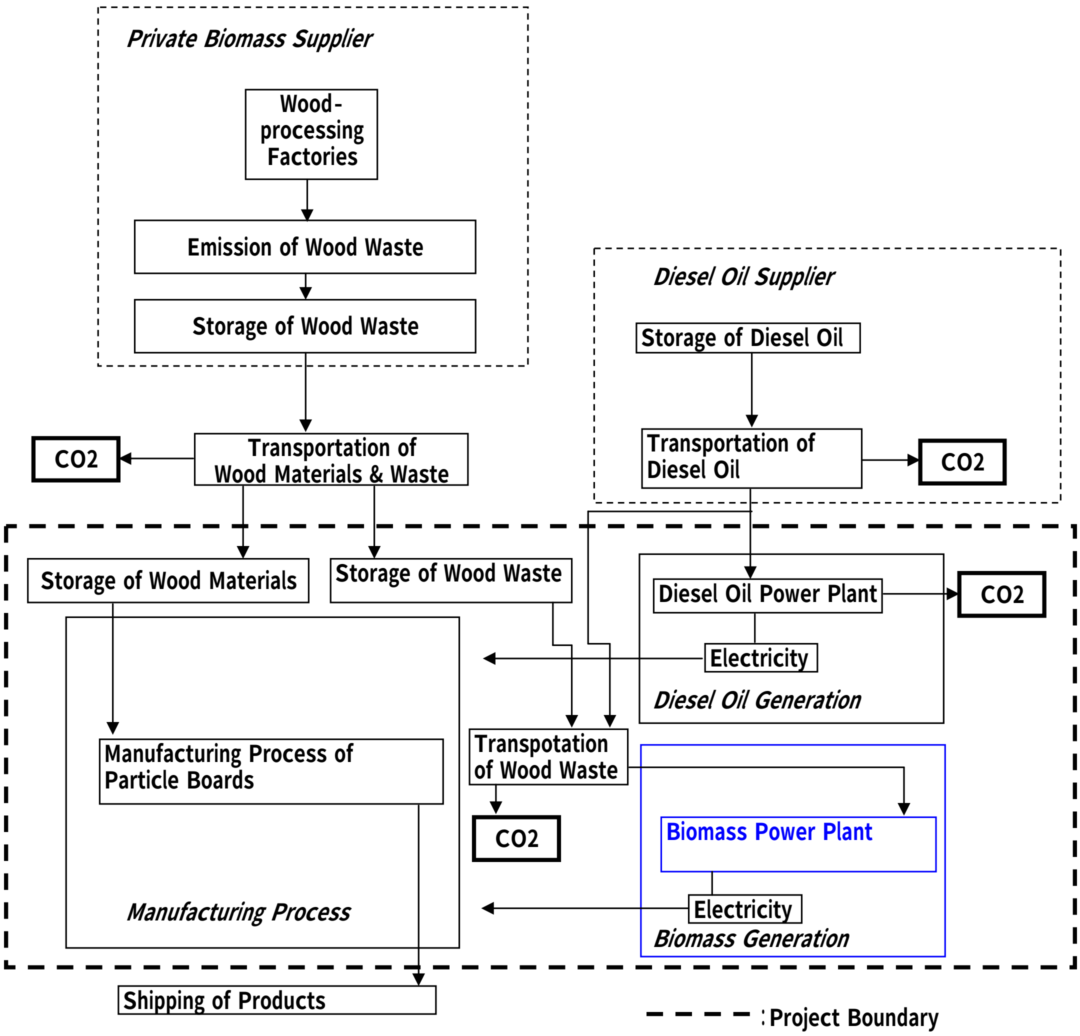

Fig- 4: Boundary of the project

B.4. Description of baseline and its development:

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PT.RPI is currently producing the power consumed at its own plant, using diesel-powered generators, but because of the steep rise in the price of petroleum products the company has examined the use of alternative forms of energy or on-site power generation.

For alternative forms of energy, the company has examined proposals for purchasing power from public power companies, using natural gas as a substitute for the current diesel engine fuel, and creating on-site power generation that uses coal or wood biomass.

The price for purchasing power from public power companies, including taxes, is about 1,010Rp/kWh (as of December 2005), which would be about 28% cheaper than the cost of operating the company's existing diesel-powered generators (1,400Rp/kWh). Even after paying the required application fee, deposit, and construction fees, the total would be about US$560,000, so purchasing such power would have had its merits. The problem was that in Indonesia, along with steep rising petroleum product prices, the price of power was rising, and this made it difficult for the company to determine the capital investment. As of January 2007, the price quoted to new large-scale users had risen to 1,380Rp/kWh.

Moreover, purchasing power from Indonesia's public power companies would expose the company to the danger of fires resulting from frequent power outages. In the process of drying the wood chip which is used to make particle board, air is heated by an open flame burner and then passed over the wood chip to dry it, but if a power outage occurs, the air flow stops and the temperature in the drying oven rises while the humidity in the oven decreases, so the wood chip can catch on fire. Power outages also happen at times with the company's current equipment, so measures are in place to prevent the occurrence of fires when the power goes out, but when a power outages does occur, it takes time to start production back up again, resulting in lower productivity.

In addition, PT.RPI was unable to consider the use of engines powered by natural gas because of the lack of a stable supply source of that fuel. In order to achieve stable use of natural gas on the island of Java, first a pipeline would need to be constructed on the sea floor in a major gas-producing region, such as the islands of Sumatra or Kalimantan, to supply Java, and PT.RPI would have to wait for PNG (Indonesia's national gas company) to construct such facilities. This is the reason that the company could not make any plans.

The company then examined generating power using steam-driven turbines with boilers fueled by coal or wood biomass as practical forms of alternative energy, comparing their merits. The cost of power produced using coal and wood biomass as fuel for boilers, compared to the cost of power using diesel power generation, was estimated by the company to be 50% and 58%, respectively. The difference in cost between coal-generated and wood biomass-generated power is mainly due to the difference in the cost of equipment investment. There were impediments to investment for introducing power generators using wood biomass as the fuel for the boilers, but they could be overcome by making it a CDM project.

Therefore, power generation using power-generating coal boilers, the proposal which would have been chosen had power-generating wood biomass boilers not been introduced, became the baseline scenario.

The table below shows a comparison of outlines of the three scenarios: the current situation, the baseline and the project activities.

Table-3:. A comparison of the current situation, the baseline and the project activities

	Continuation of current practice	Baseline scenario	Project activity
General description	Power generation using diesel-powered generators	Power generation using steam produced by burning	Power generation using steam produced by burning
Legitimacy	In accordance with laws	In accordance with laws	In accordance with laws
Fuel and its source	Diesel oil (domestically produced)	Coal (domestically produced), with previously existing diesel-powered generators operated during inspections of power generators or when problems occur	Wood biomass (wood waste from sawmills), with previously existing diesel-powered generators operated during inspections of power generators or when problems occur
Generation capacity	4.8MW; with four generators, two of which are normally in operation (2.4MW)	4MW; The actual amount of power produced would be the 2.4MW currently used plus 0.7MW which is consumed by the introduced power generators, totalling 3.1MW	4MW; The actual amount of power produced would be the 2.4MW currently used plus 0.7MW which is consumed by the introduced power generators, totalling 3.1MW
Uses of the electricity generated	For the plant's manufacturing equipment, other facilities on the grounds and illumination; No connection with outside facilities	For the plant's manufacturing equipment, other facilities on the grounds and illumination. No connection with outside facilities	For the plant's manufacturing equipment, other facilities on the grounds and illumination. No connection with outside facilities
IRR	---------	21%	16% without CER (21% with carbon credit)
Barriers	---------	None in particular	Barriers to investment present
Practices in Indonesia	Aiming to reduce consumption of petroleum products	The country has abundant coal deposits, which are being used as an alternative to energy from petroleum products	Aiming to increase the use of renewable energy as the long-term national energy policy

In calculating the energy baseline, methodology AMS-1A (version 09) will be applied.
The amount of power generated by the existing diesel-powered generators is set as the energy baseline, and for the formula, which is applied to an extremely limited area, Option 2 will be utilized

$$E_B = \sum_i O_i / (1 - l)$$

Where:

E_B A nnual energy baseline in kWh per year

$\sum_i$ The sum over the group of "*i*" renewable energy technologies (eg solar home systems, solar pumps) implemented as part of the project. For the project, *i* is the wood biomass

O_i The estimated annual output of the renewable energy technologies of the group of "*i*" renewable energy technologies installed (in kWh per year). For the project, *i* is the wood biomass. In the baseline scenario, O_i is by using coal as the fuel

l Average technical distribution losses that would have been observed in diesel-powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction For the project, l is zero because the project does not link to the power grid

The project will continue under the current condition of no connection with external power grids and no purchase of power from outside sources. The estimated annual output of power produced using renewable energy technology will be the same as that produced by the current diesel-powered generators.

The baseline emissions volume will be the amount of emissions that would have been produced by using coal to supply the above-mentioned energy baseline (calculated using the coefficient for CO_2 emissions from coal as E_B)

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 Republic of Indonesia has a system for ensuring a stable supply of coal in terms of volume. Power generation using coal accounts for the largest share, 34% (6,650MW), of the installed capacity of the JAMALI grid (Jawa-Madura-Bali grid), which supplies power to Central Java Province (Source: RUPTL 2006-2015, PTPLN 2006)

Many plants that have been forced to use alternative energy due to the steep rise in the prices of petroleum products since 2001 (when the Indonesian government's subsidies on petroleum products were reduced) have switched to cola-fueled boilers. A major Japanese textile company which has been operating in Indonesia switched to coal-fueled boilers in eight of its plants between 2002 and 2006.

President Susilo Bambang Yudhoyono urged Indonesians to use coal as a source of energy due to the soaring fuel oil prices. (Source: Asia Pulse, 27 Oct 2005, http://aseanenergy.org/news/?p=261)

PT.RPI also suffered a decline in profit due to rising petroleum product prices and was compelled to consider alternative energy use. Candidates for alternative energy included coal and wood biomass.

Boilers which use coal as the fuel are more compact than those using wood biomass so the initial investment is less expensive (a manufacturer of the same scale equipment estimates a difference of about 15-25% in cost), so even at PT.RPI, most of the management were initially in favor of introducing coal-fueled boilers, giving priority to the profitability (based on data from the General meeting of stakeholders on December 1, 2005).

Utilizing biomass as fuel reduces emissions of GHG, and using it as an energy source can contribute to the Republic of Indonesia’s economic sustainability, so it is in accordance with government policy. But if a company is to introduce equipment using wood biomass, there needs to be a way to improve its practicality from a commercial standpoint. PT.RPI discovered that, by gaining credit for the introduction of wood biomass boilers as a CDM project, wood biomass boilers could become nearly the same in terms of profitability as coal-fueled boilers, so the directors decided unanimously to consider introducing wood biomass boilers (based on explanatory information drew on February 13, 2006 comparing the practicality from a commercial standpoint of coal versus biomass, and other sources).

Table-4 below shows internal rates of return with the current diesel power generation and with adoption of equipment using wood biomass or coal as fuel.

Table-4: Comparison of IRR with diesel power generation

The kind of fuel	Wood biomass	Coal
Without carbon credit	16%	21%
With carbon credit	21%	------

(Internal rate of return during 10 years when credit is assumed to be 10US$/t CO_2e.)

Thus, if there had not been any CDM activities, power-generating coal boilers would have been introduced for the project; therefore, that has become the baseline scenario, while the decision to adopt wood biomass power generators was made subsequently.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Baseline emissions

For calculating baseline emissions, methodology AMS-1A (version 09) will be applied.
The emissions baseline is the energy baseline calculated in accordance with paragraphs above time the CO_2 emission coefficient for the fuel displaced. IPCC default values for emission coefficients may be used.
The project will continue under the current condition of no connection with external power grids and no purchase of power from outside. The estimated annual output of power generated using renewable energy technology will be the same as that generated by the current diesel-powered generators, so E_B will be 18,663MWh/year (the average of 18,119MWh for 2004, 19,055MWh for 2005, and 18,816MWh for

2006). The actual baseline power consumption (the project's power consumption) will be determined through monitoring once the project is underway.

The emissions baseline is the energy baseline with the CO_2 emissions coefficient for coal used, so the following formula applies:

$$Em_{B},y = E_{B},y \times Emf\text{-}CO_2\text{-}coal \times Cp \times InC / Pf\text{-}coal / 10^9$$

Where:

Em_{B},y	Annual emissions baseline in t-CO_2 per year
E_{B},y	Annual energy baseline in MWh per year
$Emf\text{-}CO_2\text{-}coal$	Carbon emissions coefficient of coal for power generation (kg-CO_2/TJ)
Cp	Calorific value of power generation (kcal/kWh)
InC	International caloric unit (J/cal)
***Pf**-coal*	Efficiency of power generation using coal-fueled boilers (value provided by a coordinator of project equipment to be introduced)

All of the above except for Em_{B},y and E_{B},y are fixed values determined beforehand.

<u>Project emissions</u>

- **GHG emissions resulting from burning biomass**

The biomass to be used in the project will be wood waste, so it constitutes renewable biomass. Accordingly, the GHG emissions resulting from burning wood biomass can be considered zero.

- **Emissions within the boundary resulting from the project**

Within the boundary of the CDM project, sources of GHG resulting from project activities include fuel for the wheel loaders (diesel oil) used in transferring the wood biomass fuel unloaded from the trucks on the plant grounds and feeding it into the boilers. For the project, an additional wheel loader will be purchased for sole use in supplying biomass fuel. The amount of fuel used by the wheel loaders will be calculated by recording the flow meter readings when refueling them.
The GHG emissions will be calculated from the amount of fuel consumed using the CO_2 emissions coefficient.

$$Em_{P},y = Fv\text{-}loader,y \times (Emft\text{-}CO_2\text{-}diesel + Emft\text{-}CH_4\text{-}diesel \times GWP\text{-}CH_4 + Emft\text{-}N_2O\text{-}diesel \times GWP\text{-}N_2O) \times Cal\text{-}diesel \times Den\text{-}diesel / 10^9$$

Where:

Em_{P},y	GHG emissions from wheel loaders (ton-CO_2/year)
$Fv\text{-}loader,y$	Fuel used by wheel loaders (l/year)
$Emft\text{-}CO_2\text{-}diesel$	Diesel oil CO_2 emissions coefficient for transport of fuel (kg-CO_2/TJ)
$Emft\text{-}CH_4\text{-}diesel$	Diesel oil CH_4 emissions coefficient for transport of fuel (kg- CH_4/TJ)
$Emft\text{-}N_2O\text{-}diesel$	Diesel oil N_2O emissions coefficient for transport of fuel (kg- N_2O/TJ)
$GWP\text{-}CH_4$	Global warming potential of CH_4
$GWP\text{-}N_2O$	Global warming potential of N_2O

***Cal**-diesel*	Calorific value of diesel oil (TJ/Gg)
***Den**-diesel*	Diesel oil density (kg/l)

- **Emissions within the boundary resulting from existing power generators**

The existing diesel-powered generators will be operated as supplementary equipment during times when the CDM project equipment is undergoing inspection, if problems occur, or when there are shortages of wood biomass fuel.

The wood biomass power generators will be operated 330 days a year and during the remaining 35 days of the year, and when the generators undergo inspection and maintenance the diesel-powered generators will be operated. This is no different if coal power generators had been introduced, so the use of diesel-powered generators during inspection and maintenance of wood biomass power generators will not affect calculations of reductions in emissions.

A problem that would not have occurred in the case of using coal as fuel but may arise in the case of using wood biomass is the possibility of supply shortages. If this happens, the diesel-powered generators will be operated, the amount of power generated in this manner will be monitored and the difference from the baseline emissions will be factored into the emissions reduction figures.

$$\boldsymbol{Em}\text{-}diesel,y = \boldsymbol{Eg}\text{-}diesel,y \times \boldsymbol{Emfg}\text{-}CO_2\text{-}diesel$$

Where

***Em**-diesel,y*	Annual CO_2 emissions (ton-CO_2/year)
***Eg**-diesel,y*	Annual amount of power generated using diesel-powered generators. (if project equipment is stopped due to fuel shortages) (MWh/year)
***Emfg**-CO_2-diesel*	Emissions coefficient for diesel-powered generation (tCO_2e/MWh)

<u>Leakage</u>

- **Transfer of existing power generators**

The wood biomass power generators to be introduced by the project activities will be newly built, and plans also call for existing equipment to be utilized, so there will be no leakage resulting from the transfer of power generators.

- **The transport of fuel**

GHG emissions during the transport of fuel differ depending on the current situation, the baseline, and project activities.
Since the fuel used during the transport in all three cases is diesel oil, the amounts of fuel used in transport are calculated for each case to calculate the emissions.

GHG emissions during the transport of fuel are calculated using the following formula:

$$\boldsymbol{Em}_T,y = (\boldsymbol{Ftv}\text{-}wood,y + \boldsymbol{Ftv}\text{-}diesel,y + \boldsymbol{Ftv}\text{-}loader,y - \boldsymbol{Ftv}\text{-}coal,y) \times (\boldsymbol{Emft}\text{-}CO_2\text{-}diesel + \boldsymbol{Emft}\text{-}CH_4\text{-}diesel \times \boldsymbol{GWP}\text{-}CH_4 + \boldsymbol{Emft}\text{-}N_2O\text{-}diesel \times \boldsymbol{GWP}\text{-}N_2O) \times \boldsymbol{Cal}\text{-}diesel \times \boldsymbol{Den}\text{-}diesel / 10^9$$

Where,

***Em**$_T$,y*	GHG emissions during the transport of the fuel (ton-CO_2/year)
***Ftv**-wood,y*	Fuel used in wood biomass transport (*l*/year)
***Ftv**-diesel,y*	Fuel used in diesel oil transport (*l*/year)
***Ftv**-coal,y*	Fuel used in coal transport (*l*/year)
***Ftv**-loader,y*	Fuel used in transport diesel oil for the wheel loader (*l*/year)
***Emft**-CO_2-diesel*	Diesel oil CO_2 emissions coefficient for transport of fuel (kg-CO_2/TJ)
***Emft**-CH_4-diesel*	Diesel oil CH_4 emissions coefficient for transport of fuel (kg- CH_4/TJ)
***Emft**-N_2O-diesel*	Diesel oil N_2O emissions coefficient for transport of fuel (kg- N_2O/TJ)
***GWP**-CH_4*	Global warming potential of CH_4
***GWP**-N_2O*	Global warming potential of N_2O
***Cal**-diesel*	Calorific value of diesel oil (TJ/Gg)
***Den**-diesel*	Density of diesel oil (kg/*l*)

***Em**$_T$,y*, ***Ftv**-wood,y*, ***Ftv**-diesel,y and **Ftv**-coal,y* are all fixed values determined beforehand.

- **Amount of wood biomass used**

The amount of wood biomass used is calculated using the following formula:

$$F_G\text{-wood},y = E_O,y \times Cp \times InC / Cal\text{-wood} / Pf\text{-wood} / 10^3$$

***F**$_G$-wood,y*	Amount of wood biomass used (tons/year)
***E**$_O$,y*	Total amount of power generated annually (MWh/year)
Cp	Calorific value of power generation (kcal/kWh)
InC	International caloric unit (J/cal)
***Cal**-wood*	Calorific value of wood (TJ/Gg)
***Pf**-wood*	Efficiency of power generation using wood biomass boilers (figure provided by a coordinator for introduced equipment)

The total amount of power generated is the sum of the amounts needed to run the existing equipment and facilities (the baseline amount of power generated) plus the amount of power consumed by the equipment to be introduced.

All of the above values, except ***F**$_G$-wood,y* and ***E**$_O$,y* are fixed values determined beforehand.

- **Fuel used in transport of wood biomass (*l*/year)**

The amount of fuel used in the transport of wood biomass is calculated using the following formula:

$$Ftv\text{-wood},y = F_G\text{-wood},y / T\text{-wood} \times D\text{-wood} / M\text{-wood}$$

Where,

***Ftv**-wood,y*	Fuel used in wood biomass transport (*l*/year)
***F**$_G$-wood,y*	Amount of wood biomass used (tons/year)
***T**-wood*	Average load capacity of vehicles that collect wood biomass fuel (tons/vehicle / trips)
***D**-wood*	Distance traveled by vehicles that collect wood biomass fuel (km/vehicle / trips)
***M**-wood*	Fuel consumption of vehicles that collect wood biomass fuel (km/*l*)

All of the above values, except ***Ftv**-wood,y* and ***F**$_G$-wood,y* are fixed values determined beforehand.

➢ **Fuel used in transport of diesel oil (*l*/year)**

The amount of fuel used in the transport of diesel oil is calculated using the following formula:

$$Ftv\text{-}diesel,y = F_G\text{-}diesel,y / T\text{-}diesel \times D\text{-}diesel / M\text{-}diesel$$

Where,

***Ftv**-diesel,y*	Fuel used in diesel oil transport (*l*/year)
F_G*-diesel,y*	Amount of diesel oil used (*l*/yr) (during shortages of wood biomass fuel)
***T**-diesel*	Average load capacity of vehicles that transport diesel oil (liters/vehicle / trips)
***D**-diesel*	Distance traveled by vehicles that transport diesel oil (km/vehicle / trips)
***M**-diesel*	Fuel consumption of vehicles that transport diesel oil (km/*l*)

The amount of diesel oil used during shortages of wood biomass fuel (F_G*-diesel, l*/year) is calculated using the following formula:

$$F_G\text{-}diesel,y = Eg\text{-}diesel,y \times Cp \times InC / Cal\text{-}diesel / Den\text{-}diesel / 10^3$$

Where,

F_G*-diesel,y*	Amount of diesel oil used (*l*/yr) (during shortages of wood biomass fuel)
***Eg**-diesel,y*	Annual amount of power generated by diesel (when project equipment is stopped due to fuel shortages) (MWh/year)
Cp	Calorific value of power generation (kcal/kWh)
InC	International caloric unit (J/cal)
***Cal**-diesel*	Calorific value of diesel oil (TJ/Gg)
***Den**-diesel*	Density of diesel oil (kg/*l*)

All of the above values, except ***Ftv**-diesel,y* , F_G*- diesel,* and ***Eg**-diesel,y* are fixed values determined beforehand.

➢ **Fuel used in transport of diesel oil for wheel loader (*l*/year)**

The amount of fuel used in the transport of diesel oil for wheel loader which is exclusively used for the project is calculated using the following formula:

$$Ftv\text{-}loader,y = Fv\text{-}loader,y / T\text{-}diesel \times D\text{-}diesel / M\text{-}diesel$$

Where,

***Ftv**-loader,y*	Fuel used in transport diesel oil for the wheel loader (*l*/year)
***Fv**-loader,y*	Fuel used by the wheel loader (l/year)
***T**-diesel*	Average load capacity of vehicles that transport diesel oil (liters/vehicle / trips)
***D**-diesel*	Distance traveled by vehicles that transport diesel oil (km/vehicle / trips)
***M**-diesel*	Fuel consumption of vehicles that transport diesel oil (km/*l*)

➢ **Fuel used in transport of coal (*l*/year)**

The amount of fuel used in the transport of coal is calculated using the following formula:

$$Ftv\text{-}coal,y = F_G\text{-}coal,y / T\text{-}coal \times D\text{-}coal / M\text{-}coal$$

Where,

***Ftv**-coal,y*	Fuel used in coal transport (*l*/year)
F_G*-coal,y*	Amount of coal used (tons/year)

***T**-coal*	Average load capacity of vehicles that transport coal (tons/vehicle / trips)
***D**-coal*	Distance traveled by vehicles that transport coal (km/vehicle / trips)
***M**-coal*	Fuel consumption of vehicles that transport coal (km/*l*)

The amount of coal used (F_G*-coal,y*, tons/year) is calculated using the following formula:

$$F_G\text{-}coal,y = E_O,y \times Cp \times InC \,/\, Cal\text{-}coal \,/\, Pf\text{-}\mathrm{coal} \,/\, 10^3$$

Where,

F_G*-coal,y*	Amount of coal used (tons/year)
E_O***,y***	Total amount of power generated annually (MWh/year)
Cp	Calorific value of power generation (kcal/kWh)
InC	International caloric unit (J/cal)
***Cal**-coal*	Calorific value of coal (TJ/10^3ton)
***Pf**-coal*	Efficiency of power generation using coal-fueled boilers (value provided by a coordinator of project equipment to be introduced)

All of the above values, except ***Ftv**-coal,y*, F_G*-coal,y* **and** E_O***,y*** are fixed values determined beforehand.

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

➢ **Data for Baseline emissions**

Data / Parameter:	***Emf**-CO_2-coal*
Data unit:	kg-CO_2/TJ
Description:	CO_2 emissions coefficient for coal for power generation
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	96,100
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines. Type of coal: Sub-Bituminous Coal
Any comment:	N/A

➢ **Data for Baseline emissions & Leakage**

Data / Parameter:	***Cp***
Data unit:	kcal/kWh
Description:	Calorific value of power generation
Source of data used:	Based on definitions
Value applied:	860
Justification of the choice of data or description of	Conversion of power into a calorific value

measurement methods and procedures actually applied :	
Any comment:	N/A

Data / Parameter:	***InC***
Data unit:	J/cal
Description:	International caloric unit
Source of data used:	Based on definitions
Value applied:	4.1868
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conversion of a calorific value into energy
Any comment:	N/A

Data / Parameter:	***Pf****-coal*
Data unit:	%
Description:	Efficiency of power generation using coal-fueled boilers
Source of data used:	Value provided by a coordinator of project equipment
Value applied:	18.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Power energy when generating 4MW/hr is (a) 3,440,000 kcal/hr. Steam required to run the turbines has the following characteristics: Amount: 19.8 ton/hr Pressure: 3.7Mpa Temperature: 420 deg.c. Steam supplied from the boilers to the turbines has the following characteristics: Amount: 20 ton/hr (20,000kg/hr) Pressure: 3.82Mpa Temperature: 435 deg.c. Amount of energy at this time is 3,223kJ/kg, which equals 769.8kcal/kg when it is converted to its calorific value. Therefore, 20 tons of steam is equivalent to 15,396,000kcal/hr. Thermal efficiency of the coal-fueled boiler design provided by the boiler manufacturers involved in the project is 84%, so the energy needed from burning the coal is (b) 18,328,571kcal/hr, and because this amount of energy is required to generate 4MW of power, the efficiency is calculated to be 18.8%, (a)/(b)%.
Any comment:	N/A

- **Data for Project emissions**

Data / Parameter:	***Emfg****-CO_2-diesel*
Data unit:	$kgCO_2e/kWh$
Description:	CO_2 emissions coefficient of diesel power generation
Source of data used:	Methodology, AMS-1.A. version number 09
Value applied:	0.8
Justification of the	It is according to the AMS-1.A. version number 09.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	N/A

- **Data for Project emissions & Leakage**

Data / Parameter:	***Emft***-*CO_2-coal*
Data unit:	kg-CO_2/TJ
Description:	CO_2 emissions coefficient of diesel oil for transport of fuel
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	74,100
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines.
Any comment:	N/A

Data / Parameter:	***Emft***-*CH_4-diesel*
Data unit:	kg-CH_4/TJ
Description:	CH_4 emissions coefficient of diesel oil for transport of fuel
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	3.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines.
Any comment:	N/A

Data / Parameter:	***Emft***-*N_2O-diesel*
Data unit:	kg-N_2O/TJ
Description:	N_2O emissions coefficient of diesel oil for transport of fuel
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	3.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines.
Any comment:	N/A

Data / Parameter:	***GWP***-CH_4

Data unit:	--------
Description:	Global warming potential of CH_4
Source of data used:	1996 IPCC Science of climate change
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 1996 IPCC Science of climate change.
Any comment:	N/A

Data / Parameter:	***GWP***-N_2O
Data unit:	--------
Description:	Global warming potential of N_2O
Source of data used:	1996 IPCC Science of climate change
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 1996 IPCC Science of climate change.
Any comment:	N/A

Data / Parameter:	***Cal**-diesel*
Data unit:	TJ/Gg
Description:	Calorific value of diesel oil
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	43.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines.
Any comment:	N/A

Data / Parameter:	***Den**-diesel*
Data unit:	kg/*l*
Description:	Density of diesel oil
Source of data used:	Product catalog of the national petroleum company Pertamina
Value applied:	0.837
Justification of the choice of data or description of measurement methods and procedures actually	Measurements made by the national petroleum company Pertamina

applied :	
Any comment:	N/A

- **Data for Leakage**

Data / Parameter:	***Cal**-wood*
Data unit:	TJ/Gg
Description:	Calorific value of diesel oil
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	15.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is according to the 2006 IPCC Guidelines .
Any comment:	N/A

Data / Parameter:	***Pf**-wood*
Data unit:	%
Description:	Efficiency of the power generation using wood biomass boilers
Source of data used:	Value provided by a coordinator of project equipment
Value applied:	17.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Power energy when generating 4MW/hr is (a) 3,440,000kcal/hr. Steam required to run the turbines has the following characteristics: Amount: 19.8 ton/hr Pressure: 3.7Mpa Temperature: 420 deg.c. Steam supplied from the boilers to the turbines has the following characteristics: Amount: 20 ton/hr Pressure: 3.82Mpa Temperature: 435 deg.c. Amount of energy at this time is 3,223kJ/k, which equals 769.8kcal/kg when it is converted to its calorific value. Therefore, 20 tons of steam is equivalent to 15,396,000kcal/hr. Thermal efficiency of the coal-fueled boiler design provided by the boiler manufacturers involved in the project is 80%, so the energy needed from burning the coal is (b) 19,245,000kcal/hr, and because this amount of energy is required to generate 4MW of power, the efficiency is calculated to be 17.9%, (a)/(b)%.
Any comment:	N/A

Data / Parameter:	***Cal**-coal*
Data unit:	TJ/Gg
Description:	Calorific value of coal
Source of data used:	2006 IPCC Guidelines for National Greenhouses Gas Inventories
Value applied:	18.9
Justification of the choice of data or description of	It is according to the 2006 IPCC Guidelines. Type of coal: Sub-Bituminous Coal

measurement methods and procedures actually applied :	
Any comment:	N/A

Data / Parameter:	***Pf**-coal*
Data unit:	%
Description:	Efficiency of power generation using coal-fueled boilers
Source of data used:	Value provided by a coordinator of project equipment
Value applied:	18.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Power energy when generating 4MW/hr is (a) 3,440,000 kcal/hr. Steam required to run the turbines has the following characteristics: Amount: 19.8 ton/hr Pressure: 3.7Mpa Temperature: 420 deg.c. Steam supplied from the boilers to the turbines has the following characteristics: Amount: 20 ton/hr (20,000kg/hr) Pressure: 3.82Mpa Temperature: 435 deg.c. Amount of energy at this time is 3,223kJ/kg, which equals 769.8kcal/kg when it is converted to its calorific value. Therefore, 20 tons of steam is equivalent to 15,396,000kcal/hr. Thermal efficiency of the coal-fueled boiler design provided by the boiler manufacturers involved in the project is 84%, so the energy needed from burning the coal is (b) 18,328,571kcal/hr, and because this amount of energy is required to generate 4MW of power, the efficiency is calculated to be 18.8%, (a)/(b)%.
Any comment:	N/A

B.6.3 Ex-ante calculation of emission reductions:

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- **Baseline emissions**

Baseline emissions calculated are 34,350 tons CO_2 per year using the following formula:

$$Em_{B},y = E_{B},y \times Emf\text{-}_{CO_2}\text{-}coal \times Cp \times Inc / Pf / 10^9$$
$$= 18,663 \times 96,100 \times 860 \times 4.1868 / 0.188 / 10^9$$
$$= 34,350$$

- **Emissions within the boundary resulting from the project**

Currently, the same kind of wheel loaders that are used to carry raw materials are being used, so to calculate the amount of fuel consumed in transporting the fuel, the amount of fuel consumption expected to be needed for the project is estimated. Calculating GHG emissions using the formula below yields 72 tons CO_2 per year.

$$Em_{P},y = Fv\text{-}loader,y \times Den\text{-}diesel \times Emft\text{-}_{CO_2}\text{-}diesel \times Cal\text{-}diesel / 10^9$$
$$= 26,402 \times \times (74,100 + 3.9 \times 21 + 3.9 \times 310) \times 43.0 \times 0.837 / 10^9$$
$$= 72$$

- **Emissions within the boundary resulting from existing power generators**

Emissions when operating existing diesel-powered generators during shortages of wood biomass fuel are calculated using the formula below.
Under the current situation, there is no need to be concerned about shortages of wood biomass fuel, so the annual amount of diesel-generated power (***Eg**-diesel,y*) can be considered zero.

$$\boldsymbol{Em}\text{-}diesel,y = \boldsymbol{Eg}\text{-}diesel,y \times \boldsymbol{Emfg}\text{-}CO_2\text{-}diesel$$
$$= 0 \times 0.8$$
$$= 0$$

- **Consideration of leakage resulting from the transport of fuel**

When leakage is calculated on the basis of total power generated annually (E_O,y) after implementing the project, with the amount of diesel oil used in transporting fuel in the current situation and for baseline and project activity situations, it is calculated to be 970 tons CO_2 per year.

$$Em_T,y = (\boldsymbol{Ftv}\text{-}wood,y + \boldsymbol{Ftv}\text{-}diesel,y + \boldsymbol{Ftv}\text{-}loader,y - \boldsymbol{Ftv}\text{-}coal,y)$$
$$\times(\boldsymbol{Emft}\text{-}CO_2\text{-}diesel + \boldsymbol{Emft}\text{-}CH_4\text{-}diesel \times \boldsymbol{GWP}\text{-}CH_4 + \boldsymbol{Emft}\text{-}N_2O\text{-}diesel \times \boldsymbol{GWP}\text{-}N_2O)$$
$$\times \boldsymbol{Cal}\text{-}diesel \times \boldsymbol{Den}\text{-}diesel / 10^9$$
$$= (384{,}556 + 0 + 47 - 27{,}008) \times (74{,}100 + 3.9 \times 21 + 3.9 \times 310) \times 43.0 \times 0.837 / 10^9$$
$$= 357{,}595 \times 75{,}390.9 \times 43.0 \times 0.837 / 10^9$$
$$= 970$$

- **The amount of wood biomass used**

The amount of wood biomass used is calculated using the following formula:

$$F_G\text{-}wood,y = E_O,y \times \boldsymbol{Cp} \times \boldsymbol{InC} / \boldsymbol{Cal}\text{-}wood / \boldsymbol{Pf}\text{-}wood / 10^3$$
$$= 24{,}207 \times 860 \times 4.1868 / 15.6 / 0.179 / 10^3$$
$$= 31{,}214$$ (The amount used monthly is 2,601 tons per month.)

- **Fuel used in transport of wood biomass (*l*/year)**

The amount of fuel used in transport of wood biomass is calculated using the following formula:

$$\boldsymbol{Ftv}\text{-}wood,y = F_G\text{-}wood,y / \boldsymbol{T}\text{-}wood \times \boldsymbol{D}\text{-}wood / \boldsymbol{M}\text{-}wood$$
$$= 31{,}214 / 5 \times 308 / 5$$
$$= 384{,}556$$

The load capacity of the transporting vehicles (***T**-wood*) and the calorific value (***M**-wood*) have small error values after the project's implementation and are thought to have little impact on the emissions volume, so the figures are considered as fixed values.
The distance travelled (***D**-wood*) was estimated from weighted averages of distance travelled and the amount transported. So, the distance travelled was estimated at 308km for ex-ante calculation. (See Annex 3)

- **Fuel used in transport of diesel oil (*l*/year)**

The amount of fuel used in transport of diesel oil is calculated using the following formula:

$$\boldsymbol{Ftv}\text{-}diesel,y = F_G\text{-}diesel,y / \boldsymbol{T}\text{-}diesel \times \boldsymbol{D}\text{-}diesel / \boldsymbol{M}\text{-}diesel$$
$$= 0 / 16{,}000 \times 60 / 3$$
$$= 0$$

The load capacity of the transporting vehicles (***T**-diesel*) and the calorific value (***M**- diesel*) have small error values after the project's implementation and are thought to have little impact on the emissions volume, so the figures are considered as fixed values.
The distance travelled (***D**-diesel*) is the round-trip distance between the plant and Semarang Harbor, which is considered as a fixed value.

➢ **Fuel used in transport of diesel oil for wheel loader (*l*/year)**

The amount of fuel used in the transport of diesel oil for wheel loader which is used exclusively for the project is calculated using the following formula:

$$\boldsymbol{Ftv}\text{-}loader,y = \boldsymbol{Fv}\text{-}loader,y \,/\, \boldsymbol{T}\text{-}diesel \times \boldsymbol{D}\text{-}diesel \,/\, \boldsymbol{M}\text{-}\ diesel$$
$$= 37{,}786 / 16{,}000 \times 60 / 3$$
$$= 47$$

The load capacity of the transporting vehicles (***T**-diesel*) and the calorific value (***M**- diesel*) have small error values after the project's implementation and are thought to have little impact on the emissions volume, so the figures are considered as fixed values.
The distance travelled (***D**-diesel*) is the round-trip distance between the plant and Semarang Harbor, which is considered as a fixed value.

➢ **Fuel used in transport of coal (*l*/year)**

The amount of fuel used in transport of coal is calculated using the following formula:

$$\boldsymbol{Ftv}\text{-}coal,y = \boldsymbol{F_G}\text{-}\ coal,y \,/\, \boldsymbol{T}\text{-}coal \times \boldsymbol{D}\text{-}coal \,/\, \boldsymbol{M}\text{-}coal$$
$$= 24{,}530 / 20 \times 60 / 2$$
$$= 36{,}795$$

Here, the baseline amount of coal used is calculated using the following formula:

$$\boldsymbol{F_G}\text{-}\ coal,y = \boldsymbol{E_O},y \times \boldsymbol{Cp} \times \boldsymbol{InC} \,/\, \boldsymbol{Cal}\text{-coal} \,/\, \boldsymbol{Pf}\text{-coal} \,/\, 10^3$$
$$= 24{,}207 \times 860 \times 4.1868 / 18.9 / 0.188 / 10^3$$
$$= 24{,}530$$

The load capacity of the transporting vehicles (***T**-coal*) and the calorific value (***M**- coal*) have small error values after the project's implementation and are thought to have little impact on the emissions volume, so the figures are considered as fixed values.
The distance travelled (***D**-coal*) is the round-trip distance between the plant and Semarang Harbor, which is considered as a fixed value.

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

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The predicted decrease in GHG emissions ($\boldsymbol{ER_O},y$) resulting from the project is calculated using the following formula:

$$\boldsymbol{ER_O},y = \boldsymbol{Em_B},y - (\boldsymbol{Em_P},y + \boldsymbol{Em}\text{-}diesel,y) - \boldsymbol{Em_T},y$$
$$= 34{,}350 - (72 + 0) - 970$$
$$= 33{,}308$$

Table-5: Summary of the ex-ante annual emission reductions during the first crediting period

year	Estimation of Project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2008	72	34,350	970	33,308
2009	72	34,350	970	33,308
2010	72	34,350	970	33,308
2011	72	34,350	970	33,308
2012	72	34,350	970	33,308
2013	72	34,350	970	33,308
2014	72	34,350	970	33,308
Total	504	240,450	6,790	233,156
Average	72	34,350	970	33,308

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

B.7.1 Data and parameters monitored:

Data monitored and required for verification and issuance are to be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for the project activities, whichever occurs later.

The organization chart of PT.RPI for monitoring is presented in Annex 4.

➢ **Parameter for Baseline emissions**

Data / Parameter:	$E_{B,y}$
Data unit:	MWh/year
Description:	Baseline amount of power generated (excluding consumption by the power generators themselves)
Source of data to be used:	Actual amount of power generated recorded by PT.RPI
Value of data	18,663
Description of measurement methods and procedures to be applied:	A wattmeter is installed for the biomass power generators and the values from all of them are recorded. The power generators are operated 24 hours and day, and the four employees in charge of the equipment are rotated in a three shift per day cycle. Values from the wattmeter in each shift are recorded in a log book each shift by the person in charge for the generators. Once a month, the results are collected and reported to the Accounting & Finance Division. The Power House & Heavy Equipment Section of Technical Division will calculate the GHG emissions related to the CDM project and report that to the Accounting & Finance Division. Estimated value: $E_{B,y}$ = 18,663 This is the average amount of power generated over the three years from 2004 to 2006. 2004: 18,119MWh 2005: 19,055MWh 2006: 18,816MWh
QA/QC procedures to	The precision of the measuring device is controlled by the ISO 9001 management

be applied:	system.
Any comment:	N/A

➢ **Emissions from the project within the boundary**

Data / Parameter:	***Fv**-loader,y*
Data unit:	*l* / year
Description:	Amount of fuel used by the wheel loaders
Source of data to be used:	Actual amount of fuel recorded by PT.RPI
Value of data	26,402
Description of measurement methods and procedures to be applied:	Values are recorded using a measuring device in the refueling equipment at the refueling stations on the plant grounds. Vehicles are refueled once or twice a day. For the project, an additional wheel loader will be purchased for sole use in supplying biomass fuel. The operator of this wheel loader drives it to the refueling station, where the person in charge of the Purchasing Division performs the refueling and records in a log book, which is always maintained at the refueling station. Date of refueling, vehicle number, amount of fuel and name of person refueling are recorded. Once a month, the amount of fuel used by each vehicle is reported to the Power House & Heavy Equipment Section of Technical Division. The Power House & Heavy Equipment Section of Technical Division will calculate the GHG emissions related to the CDM project and report that information to the Accounting & Finance Division. Estimated value: PT.RPI plans to purchase the same type of wheel loader for the project as is currently used to transport wood materials. The amount of fuel consumed by the wheel loader for the transportation of biomass fuel for the project is estimated according to the actual values in 2006 of wood materials carried by the wheel loaders and the actual amount of fuel they consumed. Result of fuel consumption for wheel loaders transporting wood materials in 2006 were: Raw materials carried: 142,577 ton/year Fuel consumed: 120,596 *l*/year Estimated annual amount of wood biomass consumed: 31,214 tons per year (2,601 tons per month). Therefore, amount of fuel consumed is calculated using the following formula: 31,214 × 120,596 / 142,577 = 26,402
QA/QC procedures to be applied:	The precision of the measuring equipment is controlled by the ISO 9001 management system.
Any comment:	N/A

➢ **Emissions from existing power generators within the boundary**

Data / Parameter:	***Eg**-diesel,y*
Data unit:	kWh/year
Description:	Annual amount of diesel power generation (during shortages of wood biomass fuel)
Source of data to be used:	Actual amount of power generated recorded by PT.RPI

Value of data	0
Description of measurement methods and procedures to be applied:	A wattmeter is installed for the diesel-powered generators and the values from all of them are recorded. Values from the wattmeter in each shift are recorded in a log book each shift by the person in charge for the generators. Once a month, the results are collected and reported to the Accounting & Finance Division. The Power House & Heavy Equipment Section of Technical Division will calculate the GHG emissions related to the CDM project and report that to the Accounting & Finance Division. Estimated value: At this time, it is thought to be possible to ensure plentiful supplies of wood biomass fuel, so our estimate is zero.
QA/QC procedures to be applied:	The precision of the measuring equipment is governed by the ISO 9001 Management System.
Any comment:	N/A

- **Parameter for Leakage**

Data / Parameter:	***Fw****-wood,y*
Data unit:	ton/year
Description:	Total amount of wood waste for biomass boiler
Source of data to be used:	Actual amount of wood waste recorded by PT.RPI
Value of data	31,214
Description of measurement methods and procedures to be applied:	When the wood waste for the fuel is carried, PT.RPI weighs the track with the wood waste using a truck scale. Next, after the wood waste for the fuel is lowered in the stockyard, only the track is weighed. The difference between the two weights is recorded as the amount of wood waste. The person in charge of the Production control section performs measurement and record. After confirmation by the Purchasing Division, the Power House & Heavy Equipment Section of Technical Division will calculate the GHG emissions related to the CDM project and report that to the Accounting & Finance Division.
QA/QC procedures to be applied:	The precision of the measuring equipment is controlled by the ISO 9001 management system.
Any comment:	N/A

Data / Parameter:	E_{O},y
Data unit:	MWh/year
Description:	Total amount of power generated by wood biomass
Source of data to be used:	Actual amount of power generated recorded by PT.RPI
Value of data	24,207
Description of measurement methods and procedures to be applied:	A wattmeter is installed for the biomass power generators and the values from all of them are recorded. The power generators are operated 24 hours day, and the four employees in charge of the equipment are rotated in a three shift per day. Values from the wattmeter in each shift are recorded in a log book by the person in charge for the generators. Once a month, the results are collected and reported to the Accounting & Finance Division. The Power House & Heavy Equipment Section of Technical Division will calculate the GHG emissions related to the

	CDM project and report that to the Accounting & Finance Division. Estimated value: According to the equipment manufacturer's design values, 0.7MW of power capacity is needed to run the equipment itself, so the following formula is used in the estimate: Power consumed by the power generators themselves = 0.7 × 330 × 24 = 5,544 The total power generated is the sum of the power consumed by the power generators themselves plus the energy baseline amount of power generated, i.e., the power used by the existing equipment and facilities, which comes to 18,663 + 5,544 = 24,207. Where: Annual number of days operating: 330 days Time period operating per day: 24 hours
QA/QC procedures to be applied:	The precision of the measuring equipment is controlled by the ISO 9001 management system.
Any comment:	N/A

B.7.2. Description of the monitoring plan:

>>

In order to monitor the reduction of GHG emissions, it is important to measure the amount of power generated accurately and control it.

PT.RPI has been registered as an ISO 9001-certified plant since December 29, 1999 (Certification No. 191014, Komite Akreditasi Nasional), so plans call for continual control to be maintained by documenting procedures in the ISO manual related to monitoring and autonomous monitoring of the procedures, thus achieving accurate measurement.

In the ISO control procedures manual, it is clearly specified that the measuring instruments must be calibrated once a year.

Currently, a system has been built for the operator to report the measurements of power generated by the diesel-powered generators to the Accounting & Finance Division at the end of each month. And then monthly report on the costs of power generation and manufacturing is made, and examined by the supervisors and directors, then presented to the president. The amount of power generated by the CDM project equipment will also be continually controlled under the same system. The amount of power generated by the CDM project equipment will also be continually controlled under the same system. The amount of the reduction in GHG emissions will be calculated by the Technical Division and reported to the Accounting & Finance Division.

The fuel used by the wheel loaders, forklifts and other vehicles will be separately recorded. It will also be calculated and controlled, in the same way as power generation, as a manufacturing cost. The amount of fuel used in the CDM project will be reported by the Purchasing Division to the Technical Division, which will calculate the reduction in GHG emissions and report it to the Accounting Department.

The weight of the wood biomass fuel that has been carried on the track scale as well as the raw material for production are measured and recorded. The result is reported to the Purchasing Division and confirmed. The amount of the reduction in GHG emissions will be calculated by the Technical Division and reported to the Accounting & Finance Division.

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

>>

The completion of the baseline and monitoring methodology is January 25, 2007.
The technicians determining the baseline methodology include:

1. Atsushi Ikeda

   Sumitomo Forestry Co., Ltd.
   Marunouchi Trust Tower 14F, 1-8-1, Marunouchi, Chiyoda-ku, Tokyo, JAPAN 100-8270
   Tel: +81-3-6730-3520
   E-mail: ikd@sfc.co.jp

2. Ryo Soda

   Sumitomo Forestry Co., Ltd.
   Marunouchi Trust Tower 14F, 1-8-1, Marunouchi, Chiyoda-ku, Tokyo, JAPAN 100-8270
   Tel: +81-3-6730-3520
   E-mail: rsoda@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:

>>
Foundation work for the project will be started in March 2007.

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

>>
More than 25 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 1, 2008

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
N/A

C.2.2.2. Length:

>>
N/A

SECTION D. Environmental impacts

>>

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

>>

Located in the sub-district of Kendal, Central Java Province, PT.RPI is obligated to conduct the following surveys and submit reports on them. It is currently fulfilling this obligation and will continue to conduct the same kind of control and reporting after the project is introduced.

Submission of documents to local governments

PT.RPI manufactures particle board, so it must submit, once every year, its plans to the government in the form of an Environmental Monitoring Plan and an Environmental Management Plan.

The RPL is a report on the results of environmental surveys by governmental institutions carried out twice a year. PT.RPI must assess water and air quality, noise, and vibrations with regard to its activities and report on them. PT.RPI obeys these environmental standards. PT.RPI instructed the employees to wear the protective equipment such as masks and ear plugs/ear muffs in the area where the observed value exceeds the standard value and to avoid working in a vibrating area.

In accordance with ISO 14001, the company must make and implement plans for improving the working environment regarding safety and hygiene at plants and for reducing the environmental impact, and then report on this.

The reports are submitted to the following three governmental bodies

- Dinas Perindustrian dan Perdagangan (DISPERINDAG): Kendal Sub-District Commerce and Industry Agency
- Badan Pengelolaan dan Pengendalian Dampak Lingkungan (BAPPEDAL): Central Java Province Environmental Impact Management Agency
- Pengendalian Dampak Lingkungan Daerah (PEPADAL): The Kendal Sub-District Environmental Impact Management Agency

PT.RPI obtained ISO 14001 certification (Certificate number 05/EM/023) on October 21, 2005.

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:

>>

The Republic of Indonesia has adopted a system for the Environmental Impact Assessment (EIA; "Analisis Mengenai Dampak Lingkungan", AMDAL), requiring each place of business to have a management system in line with the magnitude of impact on the environment.

When biomass power generators with a capacity of 10MW or more are introduced, they are subject to EIA, but the capacity of this project is only 4MW, so EIA is not required.

As the project utilizes wood biomass for its fuel, it is considered to generate no GHG emissions. Therefore, compared to the existing diesel power generation and the coal-fueled power generation of the baseline scenario, the project will contribute to improving the environment on a global scale.

SECTION E. Stakeholders' comments

>>

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

>>

On November 1, 2006, invitations letter for stakeholder meeting were sent to representatives of the parties concerned in the vicinity of the plant and officials of environmental-related government bodies. The stakeholder meeting was held subsequently on November 21 at the Kaliwungu sub-district offices.

At the meeting, there was an explanation of the causes of global warming, the equipment being introduced by PT.RPI and the project's objectives, followed by a Q&A session.

- **Attendees, affiliation, etc.**

(1) IWAN	Vice Head of PEDALDA Kendal Sub-District
(2) DRS. NUNG TUBENO	Head of Kaliwungu Sub-District
(3) PRASETYADI UTOMO	Secretary of DNA on CDM
(4) JOSELITO	Climate Change Division of the Department of Environment
(5) RENDRA KURNIA HASAN	Climate Change Division of the Department of Environment
(6) ASTUTI NINGSIH S.Sos	Head of government section of Kaliwungu Sub-district
(7) WAHYUDI S.Sos	Head of peace and order section of Kaliwungu Sub-district
(8) SUGIARTO	Chief of Mororejo Village
(9) NUR KHOLIS	Chief of Sub Village
(10) ISWOKO	Chief of Sub Village
(11) TURMUDI	Service Section of Mororejo Village
(12) SAFI'UDIN	Service Section of Mororejo Village
(13) KARIRI	Service Section of Mororejo Village
(14) H.YAHYA	Head of Delegation in Mororejo village
(15) H.PURNAWI	Member of Delegation in Mororejo village
(16) KY.ASRORI	Member of Delegation in Mororejo village
(17) KY.MAHMUDUN	Member of Delegation in Mororejo village
(18) EDY S.	Member of Delegation in Mororejo village
(19) SUPRIYANTO	Member of Delegation in Mororejo village
(20) MUHDHOR	Member of Delegation in Mororejo village
(21) JAYULI	Member of Delegation in Mororejo village

Fig-5 : Questions from the stakeholders

Fig-6 : Responses from PT.RPI

Fig-7: Attendees of the stakeholders meeting

E.2. Summary of the comments received:

>>

- NUR KHOLIS (Chief of Sub Village) complaint and demands:

(1) Dust from the Particle Board plant is currently polluting surrounding ponds. We have understood that improvements will be made in or after 2008 by introducing the new equipment, but can't something be done about this problem before then?

(2) We would like you to repair the road used to service the aquaculture ponds on the south side of PT.RPI.

(3) We would like you to provide some seedlings for trees on the district's soccer field and along the coast.

- SUGIARTO (Chief of Mororejo Village) complaints:

(4) Transport trucks gathering in front of PT.RPI sometimes blocked the traffic.

- IWAN (Vice Head of PEDALDA Kendal Sub-District) asks:

(5) What is the mechanism of heat energy generation using sawdust in biomass power generation?

- MUHDHOR (Member of delegation from Mororejo Village) asks:

(6) Biomass power generation will use large amounts of underground water, but will the residents' wells be okay?

- H. PURNAWI (Member of delegation from Mororejo Village) asks:

(7) Will the introduction of biomass power generation bring new employment opportunities?

- DRS. NUNG TUBENO (Head of Kaliwungu Sub-District) asks:

(8) What countermeasures are being considered for smoke exhausted from the biomass power generators?

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

>>

- Responses to complaint and demands of NUR KHOLIS

(1) Before PT.RPI uses wood waste as fuel for the project, PT.RPI will repair the covers and reduce the amount of dust produced.
(2) PT.RPI has plans to repair the road on the south side in 2007.
(3) PT.RPI is raising seedlings for planting and is able to provide some of them.

- Response to complaint of SUGIARTO

(4) PT.RPI will instruct the trucking company to send vehicles in line with the shipping schedule of PT.RPI.

- Response to question of IWAN

(5) The sawdust is burned in the boiler, transforming it into heat energy. The calorific value is about 40% that of diesel oil.

- Response to question of MUHDHOR

(6) PT.RPI has plans to take water from 100m underground, a different level from that used by the residents' wells, so it will not affect them.

- Response to question of H. PURNAWI

(7) The operators of the current diesel-powered generators are planned to be in charge of the biomass generators, and we don't know yet if any new employees will be needed.

- Response to question of DRS. NUNG TUBENO

(8) In addition to the standard drop-out chambers, plans call for the biomass power generators to have electrostatic precipitators installed, and PT.RPI aim to keep the level of soot below the government's environmental standards.

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 14F	
City:	Chiyoda-ku	
State/Region:	Tokyo	
Postfix/ZIP:	100-8270	
Country:	Japan	
Telephone:	+81-3-6730-3707	
FAX:	+81-3-6730-3521	
E-Mail:		
URL:	http://sfc.jp/ie/index.html	
Represented by:		
Title:	Manager	Team Manager
Salutation:	Mr.	Mr.
Last Name:	Ikeda	Soda
Middle Name:		
First Name:	Atsushi	Ryo
Department:	Environmental Management	
Mobile:		
Direct FAX:		
Direct tel:		
Personal E-Mail:	ikd@sfc.co.jp	rsoda@sfc.co.jp

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PT. Rimba Partikel Indonesia	
Street/P.O.Box:	127 Kendal	
Building:		
City:	Desa Mororejo, Kaliwungu, Kendal	
State/Region:	Jawa Tengah	
Postfix/ZIP:		
Country:	Indonesia	
Telephone:	+62-24-866-2990	
FAX:	+62-24-866-2988	
E-Mail:		
URL:		
Represented by:		
Title:	Director	Ass General Manager
Salutation:	Mr.	Mr.
Last Name:	Watanabe	Wijaya
Middle Name:		Johannes
First Name:	Hironori	Oei
Department:		Production & Technic
Mobile:		
Direct FAX:		
Direct tel:		
Personal E-Mail:	h-watanabe@rpi.co.id	johannes.oei@rpi.co.id

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no ODA or public aid/support for the project.

ANNEX 3
BASELINE INFORMATION

By using wood biomass as a power-generating fuel, the project comprises a plan to reduce all emissions to below the baseline level, which is the volume that would have been emitted by traditional power generators using coal-fueled boilers if it had not been for the CDM scheme.

In implementing the project, it is important to ensure an ample amount of wood biomass to use as fuel in the power generators, so we conducted a survey on the possibility of collecting fuel.

The project plans to purchase about 2,601 tons of wood biomass per month for fuel from outside of the project boundary.

As can be seen in the photos below, there are places where the project is to be implemented with piles of discarded wood waste from sawmills in the mountains in Wonosobo district of Central Java Province. Because the prices of petroleum products have risen, wood biomass has been used as a fuel, and the amount of discarded wood biomass has decreased.

Fig-8: Sawdust abandoned to the a river (Aug 30,2006)

Fig-9: A valley filled with waste (Aug 30,2006)

Fig-10: Sawdust fills the valley (Aug 30,2006)

Fig-11: A valley filled with sawdust (Oct 18,2006)

A survey was conducted to ensure that implementing the project activity would not cause other businesses that have been using wood biomass fuel to have to switch to fossil fuels on account of scarcity of wood biomass.

- **Survey of fuel generation volume**

The project is a plan to primarily use offcuts and sawdust generated by nearby sawmills as a fuel source. PT.RPI surveyed 431 sawmills along about 200 km of relatively wide roads in the vicinity of PT.RPI to check the amount of wood waste. (Conducted from August to December 2006.)

Table-6: Survey of amount of wood biomass generated for fuel.

Name of sub-district	the Number of sawmill	Offcuts (ton/month)	Sawdust (ton/month)
Kendal	24	2,402	872
Batang	49	3,160	1,930
Pekalongan	18	893	436
Tegal	4	288	81
Brebes	21	1,588	337
Demak	10	0	1,705
Ambarawa	23	1,530	430
Salatiga	23	1,360	411
Temanggung	9	100	1,386
Wonosobo	63	8,506	2,310
Banjarnegara	21	1,706	357
Banyumas	71	5,832	999
Purworejo	20	1,194	260
Jepara	22	1,286	527
Bantul	20	356	150
Boyolali	8	576	359
Wonogiri	16	1,360	387
Klaten	16	884	190
Total	431	33,021	13,127
		46,148	

The survey's results indicated that the amount of wood waste generated came to 46,148 tons per month, so the amount of fuel expected to use per month, 2,601 tons, accounts to about 6% of the total wood waste, and by collecting fuel from a wide area, it is considered that the impact on other businesses using wood biomass as fuel will be small.

- **Questionnaire to the sawmill**

In order not to diminish the current supply of wood waste to businesses using them and to keep prices stable at current levels, PT.RPI asked the sawmill owner how much they would be able to provide for the project.

The results of surveying 121 sawmills in Central Java Province confirmed that they could supply 60.3% of their offcuts and 58.4% of their sawdust to PT.RPI under the above conditions, without putting any pressure on the supply and demand situation.(**Table-7**)

Table-7: Results of the questionnaire to the sawmill.

Name of sub-district	the Number of sawmill	Offcuts (ton/month)	Sawdust (ton/month)	Supply ratio for PT.RPI	
				Offcuts	Sawdust
Wonosobo	17	2,512	731	58.4 %	60.1 %
Purwokerto	23	112	144	50.0 %	50.0 %
Purworejo	2	48	16	50.0 %	50.0 %
Temanggung	1	480	160	50.0 %	0.0 %
Kendal	10	672	226	67.3 %	75.7 %
Batang	14	1,616	548	72.5 %	60.6 %
Ambarawa	2	208	24	26.9 %	50.0 %
Yogjakarta	13	458	195	15.1 %	55.4 %
Klaten	16	1,104	222	71.7 %	68.5 %
Salatiga	16	1,408	668	66.8 %	70.8 %
Jepara	7	264	225	33.0 %	34.2 %
Total	121	8,882	1,944	60.3 %	58.4 %

- **Use of wood biomass fuel**

The results of an interview survey of sawmill businesses showed that wood biomass generated by sawmills in Central Java Province is used mostly by manufacturers of bricks or tiles in order to fire the bricks or tiles in kilns.

Brick production is conducted in the fields, where soil is mixed with chaff and sawdust. The mixture is placed in molds and allowed to dry naturally, then, as shown in the photo of Fig-11, the dried bricks are stacked inside a hut and fired for about two days. About 120,000 bricks are produced in each batch. This is done once during the rainy season and twice during the dry season, for a total of three batches a year. Twenty tons of fuel is used per batch in the rainy season, and 15 tons per batch in the dry season, for a total of 50 tons of offcuts used per year for each brick-making session.

Fig-12: Being prepared for brick firing
(Jun 22,2006)

Fig-13: Kiln is being prepared for tile firing
(Sep 1,2006)

Production of tiles is done in the gardens of private homes, where clay and sand are mixed and then formed in a manual press. They are allowed to dry naturally, then, as shown in the photograph of Fig-10, they are stacked in a hut and fired for about two days. One batch produces about 5,000 tiles. Production is conducted 24 times a year, with each tile-making session using about 120 tons of offcuts per year.

There are diverse supply sources of wood biomass in Central Java Province, and at present, even considering the amount of demand by other wood biomass users, such as brick and tile manufacturers, it is considered possible to sufficiently ensure the wood biomass be used for the project.

- Collecting wood biomass fuel

Table-8: Estimation of distance traveled to collect wood biomass fuel.

Province name	Distance to plant (km)	Sawdust (tons)	Offcuts (tons)	Total (tons)
Kendal	15	2,402	872	3,274
Batang	80	3,160	1,930	5,090
Pekalongan	85	893	436	1,329
Tegal	150	288	81	369
Brebes	165	1,588	337	1,925
Semarang	25			0
Demak	75		1,705	1,.705
Ambarawa	60	1,530	430	1,960
Salatiga	70	1,360	411	1,771
Temanggung	175	100	1,386	1,486
Wonosobo	200	8,506	2.310	10,816
Banjarnegara	230	1,706	357	2,063
Banyumas	265	5,832	999	6,831
Purworejo	200	1,194	260	1,454
Jepara	120	1,286	527	1,813
Bantul	150	356	150	506
Boyolali	100	576	359	935
Wonogiri	175	1,360	387	1,747
Klaten	100	884	190	1,074
Total		33,021	13,127	46,148
Weighted average (km)	154			

Note: Considering round trips, the fuel transport distance is twice the weighted average (i.e. 308km).

After the project is carried out, the distance in the region where the fuel is carried is fixed. The biomass quantity in each region that has been carried is recorded, totaled, and the transportation distance is calculated according to the weighted average.

Annex 4

MONITORING INFORMATION

Table-9: Data to be collected in order to monitor the emissions from the project activity, and the archiving/storage method.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c), or estimated (e)	Recording frequency	Percentage of data to be monitored	Archiving/Storage method (electronic/ paper)	Comment
E_B,y	Quantitative	Generated power	kWh	m	Continuously	100%	Electronic and paper	Power generated by the project, of which is to be supplied to existing equipment and facilities
***Eg**-diesel, y*	Quantitative	Generated power	kWh	m	Continuously	100%	Electronic and paper	Electricity generation by the diesel-powered generator (In case of shortage of wood biomass fuel)
***Fv**-loader ,y*	Quantitative	Fuel	liter	m	Each time	100%	Electronic and paper	Fuel transportation and supply to boilers by the wheel loader which is exclusively for the project, within the project boundaries
***Fw**-wood,* y	Quantitative	Fuel	ton	m	Each time	100%	Electronic and paper	Weight of fuel for wood biomass boiler
E_T,y	Quantitative	Generated power	kWh	m	Continuously	100%	Electronic and paper	Electricity generation by the project

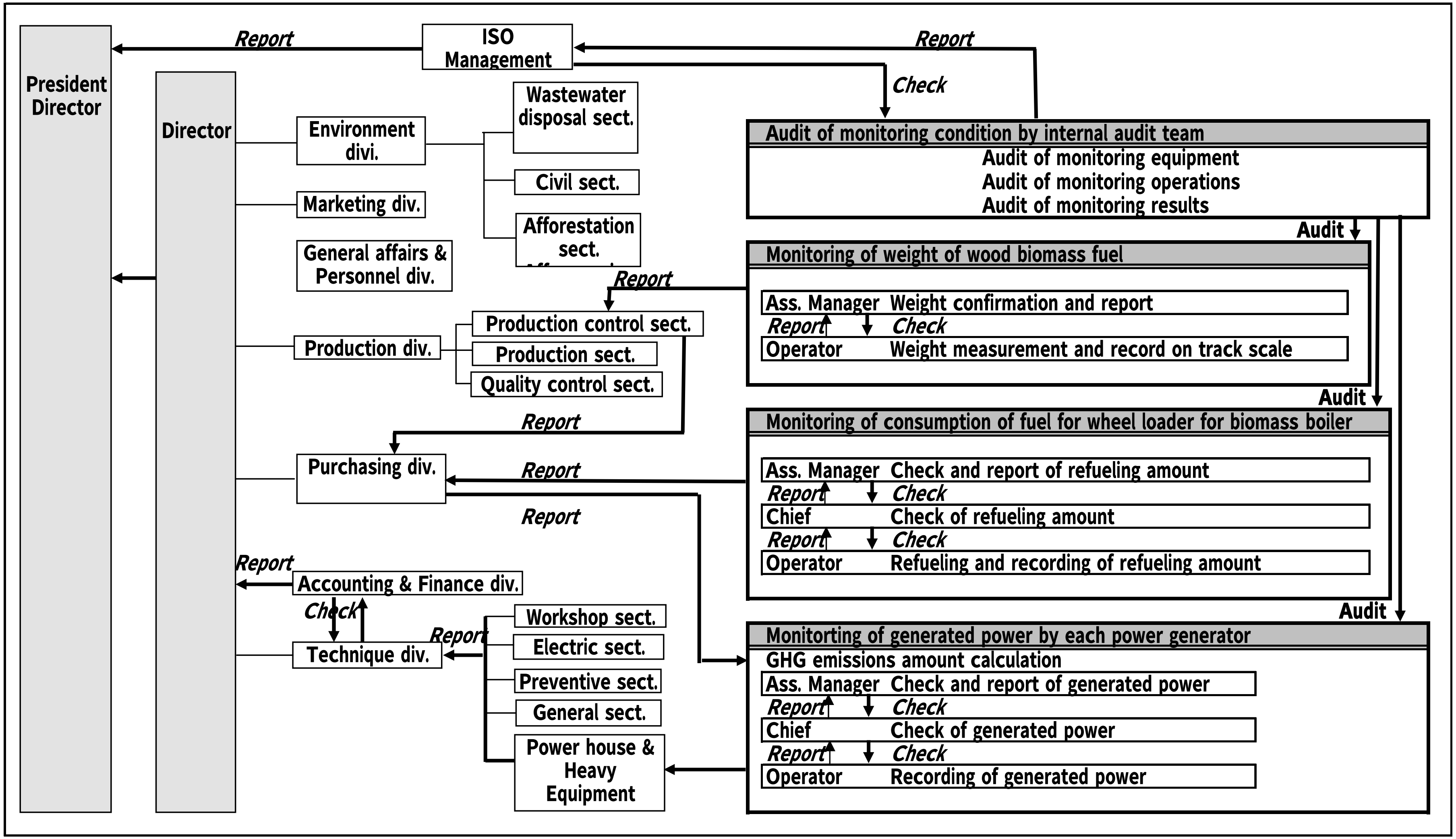

Fig-14: Organizational chart of PT.RPI for monitoring.