CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 03

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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Title – Optimization of steam consumption in the process by installation of free flow falling film finisher evaporator and retrofit to the chemical recovery boiler in Cachar Paper Mill of Hindustan Paper Corporation Limited

Version – 02

Date –21/07/2007

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

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The project activity involves replacement of cascade evaporator by free flow falling film finisher (FFFF) evaporator in the mixed feed arrangement of the multiple effect evaporator train of the Evaporator Plant of the paper production facility of Cachar Paper Mill (CPM) of Hindustan Paper Corporation Limited (HPC) and also addition of three banks of economizers along with provision of two indirect liquor heaters in the chemical recovery boiler.

Before the project activity direct contact cascade evaporator was operated as the finisher evaporator in the mixed feed multiple effect evaporator train. The concentration of black liquor solid was increased in the cascade evaporator by directly contacting the liquor with hot flue gas from chemical recovery boiler. Cascade evaporator was capable to achieve a black liquor concentration of 62% with which the black liquor was fired in the chemical recovery boiler.

The project activity, under consideration, primarily aims at efficiency improvement in steam utilization for the purpose of concentration of black liquor and also in partial replacement of fossil fuel generated steam through generation of higher quantity of steam from renewable resource black liquor[1]. The FFFF evaporator, installed under the project activity, results in higher steam economy due to improved heat

[1] Black liquor is a mixture of cooking chemicals and dissolved wood material remaining after sulphate pulp cooking. It is recovered during pulp washing, concentrated by evaporation and burned in the recovery boiler to regenerate the cooking chemicals and generate energy.

transfer characteristics, thereby leading to requirement of lesser quantity of low pressure (LP) steam[2] for concentrating a specific amount of weak black liquor through evaporation. Lower LP steam consumption in the evaporator plant, will in turn reduce the high pressure (HP) steam generation requirement from the coal fired boilers of the cogeneration plant of CPM.

The retrofit measures taken in the chemical recovery boiler result in higher black liquor solid concentration of around 70%. Combustion of higher concentration of black liquor solid in the chemical recovery boiler in-turn increases its steam output.

However, due to the increase in the number of effects integrated with the mixed feed arrangement of the evaporator train, there has been an increment in the vacuum[3] required to be created for the flow of vapour across the evaporator train. This has necessitated in an increment in the medium pressure (MP) steam[4] consumption as motive fluid in the steam jet ejector system meant for the evaporator plant. Incremental MP steam consumption under the project activity, will be accounted for as project activity emissions. Apart from the motive fluid MP steam used in the ejector system of the evaporator plant, there has also been an increment in the number of soot blowers installed in the chemical recovery boiler and consequently there has been an increment in the consumption of (MP) steam used for the purpose of soot-blowing, as a result of the project activity.

But, energy efficiency and partial fossil fuel switching achieved through the project activity, has resulted in a net reduction in thermal energy contribution from fossil fuel coal combustion and also in fossil fuel based electrical energy consumption. This has led to a consequent reduction in the GHG emissions from the cogeneration plant of CPM.

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[2] LP steam (at 4.33 kg/cm^2 pressure and 142 ^{0} C temperature) in the cogeneration plant of CPM, is made available by extraction from the turbines.

[3] In a multiple effect evaporator train like mixed feed arrangement, steam is fed in one of the effects and connections are so made that the vapour from one effect serves as the heating medium for the next. A condenser and a steam jet ejector or a vacuum pump, establish a vacuum in the final effect in the evaporator train and withdraw non-condensables from the system. The first effect of the multiple effect evaporator train is the effect to which raw steam is fed and in which pressure in the vapour space is the highest. The last effect is that in which vapour space pressure is a minimum. The pressure in each effect is lower than in the effect from which it receives steam and higher than that of the effect to which it supplies vapour.

[4] MP steam is made available by letting down high pressure (HP) steam (at 60 kg/cm^2 pressure and 400 ^{0} C) to 19 kg/cm^2 pressure and 300 ^{0} C

Project's contribution to sustainable development

The contribution of the project towards sustainable development can be described under the following indicators:

Socio-economic benefits: Indian economy is greatly driven by fossil fuels mainly coal. The project activity results in conservation of non renewable natural resource like coal thereby making it available for other important purposes. The project activity has also created scope for business opportunities for consultants, suppliers, erectors and contractors.

Environmental well-being: The project activity leads to steam optimization resulting in reduced steam generation from the coal fired boilers and consequent reduction in combustion of non-renewable resource coal in the coal fired boilers of the cogeneration plant of CPM. Consequently GHG emission mainly CO_2, from the coal combustion in the cogeneration plant are also reduced. The project also results in reduction in emissions of SO_x and NO_x associated with combustion of coal that would have occurred in absence of the project activity. Thus, the project activity leads to direct reductions of GHG (CO_2) emissions by reduced energy consumption thus contributing to the overall cause of mitigation of global warming and natural resource conservation

Technological well-being: Due to improved heat transfer characteristics, the FFFF evaporator results in higher steam economy and a black liquor solid concentration, ultimately leading to energy conservation in the cogeneration plant of CPM. The technology being employed under the project activity has a high replication potential in other pulp and paper industries of India.

Implementing such clean technologies will lead to sustainable economical and industrial growth in the long run and further conservation of natural resources like coal.

A.3. Project participants:

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Name of the 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)
Ministry of Environment and Forests (MoEF), Government of India	Hindustan Paper Corporation Limited, Unit - Cachar Paper Mill.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

India

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

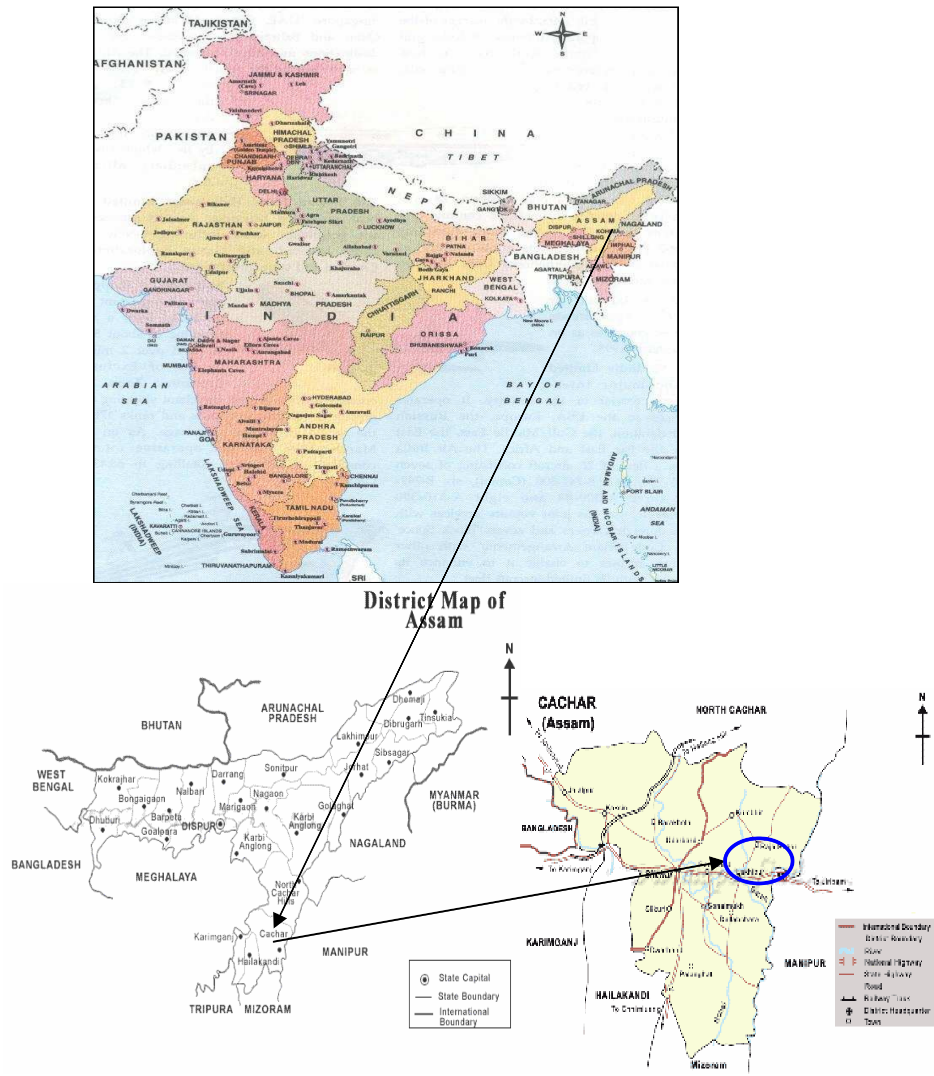
Assam

A.4.1.3. City/Town/Community etc:

Panchgram, Hailakandi district

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is located in the premises of Cachar Paper Mill, situated by the side of the Barak river in the Hailakandi district of Assam on the National Highway No. 57 between Silchar and Guwahati. The mill is located at a distance of 25 km from Silchar. There are regular bus services connecting the Mill with both Silchar and Guwahati. Panchgram railway station (North – East Frontier Railway) is situated close to the Mill at a distance of about 1 km. There is also an airport at Silchar connecting it toother parts of India through regular flights.



Maps not to scale

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

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The project falls under the UNFCCC small scale CDM project activity under Type II.D, Version 09, EB 31, Sectoral Scope 04, with project activity involving energy efficiency measures.

Main Category – Type II [Energy Efficiency Improvement Projects]

Sub Category – D [Energy efficiency and fuel switching measures for industrial facilities]

As per Appendix B of the UNFCCC defined simplified modalities and procedures for small scale CDM project activities, the category "II.D" "*comprises any energy efficiency and fuel switching measure implemented at a single industrial or mining and mineral production facility. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial or mining and mineral production processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace, modify or retrofit existing facilities or be installed in a new facility.*"

The project activity, under consideration, aims at both efficiency improvement in steam utilization for the purpose of concentration of black liquor as well as in partial replacement of fossil fuel generated steam through generation of higher quantity of steam from renewable resource black liquor.The project activity includes:-

(i) Replacement of the cascade evaporator acting as the finisher evaporator in the existing evaporator plant, with a free flow falling film finisher (FFFF) evaporator, placed downstream to the multiple effect evaporator train of the Evaporator Plant and integrated with the mixed feed arrangement of the multiple effect evaporator train.

(ii) Retrofitting of the chemical recovery boiler through addition of three banks of economizers along with provision of two indirect liquor heaters.

As a result of the project activity, energy consumption and generation in different areas of CPM, will be affected in the following ways:

- Lower LP steam consumption in the evaporator train due to increased steam economy through installation of a FFFF evaporator as the finisher evaporator. Lower LP steam consumption in the

evaporator plant, will in turn reduce the HP steam generation requirement[5] from the coal fired boilers of the cogeneration plant of CPM

- Increased HP steam generation from the chemical recovery boiler (utilizing black liquor as fuel), in turn necessitating generation of lesser quantity of HP steam from the coal fired boilers. This ultimately has resulted in indirect fossil fuel switching, leading to lower GHG emissions associated with fossil fuel (coal) combustion.
- Increased MP steam requirement as motive fluid in the steam jet ejector system of the evaporator plant, will in turn increase the HP steam generation requirement from the coal fired boilers of the cogeneration plant of CPM
- Increased MP steam requirement for the purpose of soot blowing in the chemical recovery boiler. Higher MP steam consumption in soot blowing, will in turn increase the HP steam generation requirement from the coal fired boilers of the cogeneration plant of CPM

"The aggregate energy savings of a single project may not exceed the equivalent of 60 GWh_e per year. A total saving of 60 GWh_e per year is equivalent to a maximal saving of 180 GWh_{th} per year in fuel input."

The maximum aggregate thermal energy savings expected to result from the project activity, is quantified as follows:

Impact of the project activity	Reduction/increment in energy consumption
Lower LP steam consumption in the evaporator train	26.76
Increased HP steam generation from the chemical recovery boiler	69.96
Increased MP steam requirement as motive fluid in the steam jet ejector system of the evaporator plant	2.77
Increased MP steam requirement for the purpose of soot blowing in the chemical recovery boiler	19.71

[5] HP steam is generated in the cogeneration plant of CPM, in three coal fired boilers and a chemical recovery boiler. Since chemical recovery boiler uses black liquor as fuel and production of black liquor is intimately related to the throughput of the plant, therefore in a situation of lesser requirement of HP steam generation, the reduction will happen in the generation from the coal fired boilers, thereby reducing the coal combustion in the cogeneration plant.

Total	**74.24**

Hence the quantum of reduction in coal based thermal energy consumption through the project activity in CPM is 74.24 GWh_{th} /annum, which is less than the allowable limit of 180 GWh_{th} for Category II.D projects.

A brief on the technology employed

The free flow falling film finisher (FFFF) evaporator is placed downstream to the multiple effect evaporator train of the Evaporator Plant and this FFFF evaporator is integrated with the mixed feed arrangement of the multiple effect evaporator train.

In FFFF evaporator black liquor is collected in a sump beneath the heat transfer surface and circulated to the top of the evaporator. A distributor system evenly distributes the black liquor across the plate type heat transfer surface and evaporation takes place as the liquor falls by gravity as a thin film over the heat transfer surface.

Each FFFF evaporator body heating surface consists of 1219mm x 7315 mm two-sheet elements. The steam is condensed inside the elements and the black liquor is distributed on the top of the elements. The black liquor flows freely under gravity on the outside to the bottom of the body and a circulation pump on each of the bodies of the FFFF units circulates the liquor from the bottom to the top.

The FFFF evaporator consists of three separate units and the black liquor cycle can be switched from one to another unit one or two times per shift and to facilitate uninterrupted operation.

Retrofit measures taken under the project activity in the evaporator plant

1. Addition of another surface condenser to take the load of additional evaporation
2. Removal of inter-effect circulation and transfer pumps
3. Provision of higher capacity steam flashing arrangement in evaporator section

Retrofit measures taken under the project activity in the chemical recovery boiler

1. Addition of three banks of economizers
2. Provision of two indirect liquor heaters

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
August 2007- July 2008	25664.22
August 2008- July 2009	25664.22
August 2009- July 2010	25664.22
August 2010- July 2011	25664.22
August 2011- July 2012	25664.22
August 2012- July 2013	25664.22
August 2013- July 2014	25664.22
August 2014- July 2015	25664.22
August 2015- July 2016	25664.22
August 2016- July 2017	25664.22
Total estimated reductions (tonnes of CO_2 e)	**256642.2**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	25664.22

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

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No public funding from parties included in Annex-I is available to the project activity.

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

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As mentioned in the Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities defines Debundling as the fragmentation of a large project activity into smaller parts. A small scale project activity that is a part of large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- 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 1 km of the project boundary of the proposed small-scale activity at the closest point.

No similar project activity has been implemented in CPM, which falls under the Category-II.D of "Appendix B of the simplified modalities and procedures for small scale CDM project activities" and deals with the same technology/measure. No such project activity, proposed by CPM with the same project category and technology/measure and whose boundary is within 1 km of the project boundary of the small-scale project activity under consideration at its closest point, is registered or in the advanced stage of registration with the UNFCCC in the last two years.

With the above explanation, it can be concluded that the small-scale project activity of CPM is not a debundled component of a large project activity. Therefore the project activity under consideration is eligible to make use of "Appendix B of the simplified modalities and procedures for small-scale CDM project activities" for the determination of emission reductions resulting from the 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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Title: Energy efficiency and fuel switching measures for industrial facilities.

Reference: Type II (Energy Efficiency Improvement Projects) D (Energy efficiency and fuel switching measures for industrial facilities) - Appendix B of the simplified modalities and procedures for small-scale CDM project activities of the UNFCCC CDM, (Version 09, EB 31, Sectoral Scope 04,).

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

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As per the provisions of Paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21], "to use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall[6]":

1. Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 28 of Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its second session, held at Nairobi from 6 to 17 November 2006 [FCCC/KP/CMP/2006/10/Add.1, English, Page 08][7] ; Point ii. [Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, limited to those with a maximum output of 60 GWh per year (or an appropriate equivalent)]

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[6] *Extract of paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities*

[7] *In accordance with decision 17/CP.7 (contained in document FCCC/CP/2001/13/Add.2), paragraph 6 (c), simplified modalities and procedures have been developed for the following types of small-scale CDM project actives the revised definitions of which is provided in paragraph 28 of decision -/CMP.2:*
Type I: Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent);
Type II: Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, limited to those with a maximum output of 60 GWh per year (or an appropriate equivalent)*;*
Type III: Other project activities limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually;

The project activity, under consideration, primarily aims at efficiency improvement in steam utilization for the purpose of concentration of black liquor and also in partial replacement of fossil fuel generated steam through generation of higher quantity of steam from renewable resource black liquor. The project activity will therefore reduce carbon-dioxide emissions through reduced coal based thermal energy consumption.

2. Conform to one of the project categories in Appendix B to this annex;

The project activity conforms to "Category II.D" project category in Appendix B. The justification of the same has been provided in Section A.4.2

3. Not be a debundled component of a larger project activity, as determined through Appendix C to this annex.

The project activity is not a debundled component of a larger project activity as determined through Appendix C of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21]. The justification of the same has been provided in Section A.4.5

Therefore the project activity meets the 'Small Scale CDM Project Activities' applicability criteria.

Further in accordance with Paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in this appendix (Appendix B) may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in Attachment A of this Appendix (B). The project activity faces investment barriers listed in Attachment A of Appendix B in order to reduce CO_2 emissions as required by the Paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities. The details of the barriers are enlisted in Section B3.
Hence, the use of simplified baseline methodology for the project category 'Category II.D (point 2)' specified in Appendix B is justified for determination of the baseline emission of the project activity.

B.3. Description of the project boundary:

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As per paragraph 2 under "Type II.D: Energy efficiency and fuel switching measures for industrial facilities" in Appendix B of the Simplified Modalities and Procedures for small-scale CDM project activities (Version 09, EB 31, Sectoral Scope 04), "t*he project boundary is the physical, geographical site of the industrial facility, processes or equipment that are affected by the project activity*".

The boundary, for the project activity under consideration, consists of the evaporator plant, the cogeneration plant and the electricity grid of CPM. An avenue will also be kept to account for possible increases in electricity consumption as a result of the project activity and also to capture the impact of future retrofits and their impact on steam and CO_2 savings. Therefore, if there is any additional electrical load due to retrofitting to the project activity, it will be accounted for as project activity emission and will be subtracted from baseline emissions.

B.4. Details of the baseline and its development:

CPM identified the following different potential alternative(s) to the project activity, available to any other pulp and paper industry in India..

Alternative 1 – Continuation of existing scenario

In absence of the CDM project activity, the evaporator plant - chemical recovery boiler system may continue operating with the status-quo of the existing facility i.e. HP steam may continue to be generated from the chemical recovery boilers using current process and efficiencies (though steam production efficiency may improve). There would be generation of higher amount of HP steam from the coal fired boilers of the existing cogeneration plant and also requirement of higher amount of low pressure (LP) steam in the evaporation plant of the chemical recovery boiler system. This alternative is in compliance with all applicable legal and regulatory requirements. Therefore, this alternative may be a part of the baseline.

Therefore the Alternative 1 is considered further for arriving at the baseline scenario.

Alternative 2 - The project activity not undertaken as a CDM project activity

The project activity involved the installation of a falling film evaporator as a finisher evaporator integrated with the evaporators of the evaporator plant – chemical recovery boiler system in order to decrease the specific LP steam consumption across the evaporator plant and chemical recovery boiler system. This alternative speaks of implementing the project but not as a CDM project activity. This alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative has associated barriers to its implementation which prevented CPM to implement the project activity (Please refer to Step 3: Barrier Analysis in Section B.3 below for details). The consideration of the CDM benefits (GHG abatement and financial benefits) played a key role in CPM's decision to proceed with the project activity. Therefore the alternative 2 would not be a credible and realistic alternative option for CPM to implement and can be excluded from further consideration as a possible baseline scenario.

Considering the points mentioned above, "Alternative 1: Continuation of existing scenario" can be concluded to be the viable option available to CPM in absence of the project activity and therefore, as per the methodology, this alternative option is the baseline scenario. This is further substantiated by the fact that this scenario was the status quo of the existing facility before CDM project implementation.

It has already been established in Section B.2 that the use of simplified baseline methodology for the project category 'Category II.D (point 2)' specified in Appendix B is justified for determination of the baseline emission of the project activity. As per paragraphs 3, 4 and 5 under Category II.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 9, Sectoral Scope: 4, EB 31), "*In the case of replacement, modification or retrofit measures, the baseline consists of the energy baseline of the existing facility or sub-system that is replaced, modified or retrofitted. In the case of a new facility the energy baseline consists of the facility that would otherwise be built. In the absence of the CDM project activity, the existing facility would continue to consume energy (ECbaseline, in GWh/year) at historical average levels (EChistorical, in GWh/year), until the time at which the industrial or mining and mineral production facility would be likely to be replaced ,modified or retrofitted in the absence of the CDM project activity (DATEBaselineRetrofit). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline energy consumption (ECbaseline) is assumed*

to equal project energy consumption (ECy, in GWh/year), and no emission reductions are assumed to occur

ECbaseline = EChistorical until DATEBaselineRetrofit

ECbaseline = ECy on/after DATEBaselineRetrofit

In order to estimate the point in time when the existing equipment would need to be replaced in the absence of the project activity (DATEBaselineRetrofit), project participants may take the following approaches into account:

(a) The typical average technical lifetime of the equipment type may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.

(b) The common practices of the responsible industry regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment.

The point in time when the existing equipment would need to be replaced in the absence of the project activity should be chosen in a conservative manner, i.e. if a range is identified, the earliest date should be chosen. Each energy form in the emission baseline is multiplied by an emission coefficient (in kg CO_2e/kWh). For the electricity displaced, the emission coefficient is calculated in accordance with provisions under category I.D. For fossil fuels, the IPCC default values for emission coefficients may be used."

The project activity at CPM consists of both replacement of existing finisher evaporator facility and retrofitting to the chemical recovery boiler, which would reduce the coal based thermal energy generation in CPM. In absence of the project activity, the evaporator plant would have continued to operate with the cascade evaporator as the finisher evaporator, thereby consuming thermal energy at historical average levels. The chemical recovery boiler would also have continued to operate with the existing number of economizers and higher amount of HP steam would have been continued to be generated from the coal fired boilers of CPM. It has been ascertained that the cascade evaporator would not be replaced before the completion of its life time (as can be justified on the basis of the normal lifetime of cascade evaporator in other integrated pulp and paper mills). This would not happen within the crediting period and hence the energy baseline would be the net coal based thermal energy consumption corresponding to steam consumption and generation in the cogeneration plant of CPM. Therefore the energy baseline would be the coal based thermal energy generation in CPM in absence of the project activity. In order to

estimate the baseline emissions, the energy baseline will be multiplied with the emission factor of coal in t CO_2/GWh.

Key data/ parameters used for baseline calculation:

Sl No.	Data Variable	Data Unit	Description	Data Source
1.	$\left(\frac{A_{LP}}{A_{WBL}}\right)_b$	Dimensionless	Average amount of LP steam consumed (in MT) per MT amount of weak black liquor processed in the evaporator plant in the baseline scenario	Records maintained by CPM
2.	$\left(\frac{E_{coal\_CFB}}{A_{HP\_cogen}}\right)_b$	Dimensionless	Thermal energy corresponding to coal (in MT) combusted in the coal fired boilers per MT of HP steam generation from the cogeneration plant of CPM in the baseline scenario	Records maintained by CPM
3.	$\left(\frac{A_{MP\_SJE}}{A_{WBL}}\right)_b$	Dimensionless	Average amount of MP steam consumed as motive fluid in the steam jet ejector system of the evaporator plant per MT of weak black liquor processed in the baseline scenario	Records maintained by CPM
4.	$\left(\frac{A_{MP}}{A_{HP}}\right)_b$	Dimensionless	Average amount of MP steam generated (in MT) by letting down and de-superheating of HP steam in the PRDS system in the baseline scenario.	Records maintained by CPM
5.	$\left(\frac{A_{MP\_SB}}{A_{HP\_CRB}}\right)_b$	Dimensionless	Average amount of MP steam consumed for the purpose of	Records maintained by CPM

			soot blowing in the chemical recovery boiler per MT of HP steam generated in the baseline scenario (MT)	

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:

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As per the decision 17/cp.7 para 43, a project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the project activity.

Barriers and Additionality

The simplified Modalities and Procedure for the small-scale CDM project activity, asks for an explanation to show that the project activity would not have occurred due to at least one of the following barriers as discussed below:

Investment Barrier

1) HPC internally approved the proposal for Nagaon Paper Mill (NPM) and Cachar Paper Mill (CPM) for installation of falling film finisher evaporator and extension of economizer area in chemical recovery boiler as energy efficiency improvement measures. The project activities thus initiated after the approval, had to be kept in abeyance due to the then existing depressed paper market conditions and lower realization. HPC management then came across the Kyoto Protocol – CDM system. The dual benefits associated with CDM – GHG emission reductions and the carbon credits, acted as a driving force to overcome the investment barrier. Considering both the savings that the project activity can accrue and the possible CDM benefits, after much deliberation, the scheme for installation of falling film finisher evaporator and extension of economizer area in chemical recovery boiler as energy efficiency improvement measures, was revived for NPM with a budget outlay of INR 11.07 crore. The proposal was then approved for the modifications in the evaporator – chemical recovery boiler system for NPM. The project has since then been commissioned at NPM in December 2001.

Keeping in mind the implementation and operation of the project activity at NPM, CPM proposed to seek re-approval for the project at a total cost of INR 15 crore. But at that point in time, there were other projects lined up for CPM, which had to be prioritized since they affected production and associated revenues directly. The higher cost for project activity implementation at CPM than what it had been for NPM, made it further more important for HPC management to keep their faith in CDM in going ahead with the approval of the proposal.

2) Locational disadvantage brings about several logistical and infrastructure difficulties for transportation of finished products from CPM. As a result, CPM has been forced to operate below the break-even capacity since commissioning of the paper mill. During the lifetime of the paper mill, implementation of FFFF evaporator and the retrofit measures in the chemical recovery boiler, has been one of the most capital intensive projects. In such a scenario of financial crunch, arranging funds for such a capital intensive project through internal accruals was a difficult proposition for the project proponent.

Technological Barriers

1) Non-wood fibrous raw materials, like bamboo normally have a higher ash and silica content than wood. Most of the silica gets dissolved during cooking and remains as an undesirable constituent of the black liquor. The silica causes many problems[8] as washing is difficult owing to the poor drainability of the pulp and high viscosity of black liquor. The outcome is scale-formation in evaporator tubes and deposits on the furnace walls of recovery boilers and lime sludge unsuitable for reburning. The presence of silica is a major technical obstacle to the efficient chemical recovery of non-wood black liquor. The raw material for pulp and therefrom paper manufacturing in the paper mills of HPC, is bamboo that is abundantly available in North-East India. Analysis of the bamboo that is procured as a raw material, on an average shows that silica content of the bamboo is high. High silica content in the basic raw material bamboo implied high silica content in the black liquor, available as spent liquor from the digestion process of pulp making. Falling film evaporators installed under the project activity, are plate type with

[8] Source: http://www.p2pays.org/ref/10/09590.htm

large number of lamella plates installed in segments and with a distributor for the liquid at the top. Before the implementation of the project activity, the finisher evaporator was a cascade evaporator that was a direct contact evaporator in which evaporation was affected by bringing hot combustion gases into direct contact with strong black liquor from the evaporator plant. Problem due to scaling and consequent shutdown for cleaning of the finisher evaporator, was not required in the baseline scenario. The project proponent anticipated that after the implementation of the project activity they would encounter scaling effect in the falling film finisher evaporator integrated with the mixed feed arrangement of the evaporator plant, which may lead to shutdown of the entire evaporator plant for de-scaling unlike the pre-project scenario. Apart from the scaling problem, owing to the more concentrated black liquor being handled by the chemical recovery boiler under the project activity, there is always a possibility for higher deposits on the furnace walls of recovery boilers and also unsuitability of the lime sludge for re-burning.

2) Uniform distribution of the feed liquor from the top is very important in case of FFFF evaporator, in order to maintain a thin film of liquor always flowing down the inner wall of the tube. Since the black liquor entering the evaporator train has substantial solids content, there is always a possibility for the distributor holes in the FFFF evaporator getting choked. Choking of the distributor holes causes non-uniform distribution of feed liquor from the top of the FFFF evaporator, leading to dry spot formation on the lamella plates. Dry spot formation can damage the lamella plates, thereby requiring welding at the damaged spots. In cases where the damaged spots are at the periphery, spot welding can be done to mend the plates and the black liquor under high pressure is then circulated through the evaporator. Due to the welding, there is always a chance for the condensate to be contaminated, which may change the operating parameters of the evaporation system. In case the damage due to dry spot formation is almost at the centre of the plates, then welding of the plates is difficult. The damaged plate needs to be replaced thereby requiring dismantling of that particular segment and in turn shut down of the FFFF evaporator. Shut down of the FFFF evaporator would require shut down of the entire evaporator plant since FFFF evaporator installed under the project activity, is integrated with the mixed feed arrangement of the multiple effect evaporator train of the evaporator plant. This would involve consequent financial losses.

<u>Barrier due to prevailing practice</u>

During the time of implementation the project activity was not a common practice in the similar category of industries. Moreover, apart from the Nagaon and Cachar Paper Mills of Hindustan Paper Corporation Limited, there are no other integrated pulp and paper mill in India which is entirely based on bamboo as the raw material. In absence of precedence of the project activity in bamboo based pulp and paper industries of India, the project proponent lacked adequate knowhow about reliability of the technology. Similar project activity was implemented in the company's other plant in the region (NPM) which also had come up with CDM in perspective. There was always a risk of failure due to the quality of the bamboo which subsequently affects the composition of the black liquor, and in turn the project activity that is primarily directed towards better concentration of black liquor and increased steam economy. Based only on the precedence at NPM and with CDM in serious consideration, the project proponent went ahead with the investment on the project activity.

Other Barrier(s):

In addition to all the barriers mentioned above, CPM has also faced certain other hindrances since the initiation of the project activity.

- Locational disadvantages for the plant had led to several logistical as well as infrastructure problems during erection and commissioning of the project resulting in cost over-run for the project implementation.

It has been clearly established from the above discussion that the project activity faced hindrances in its implementation and also faces certain risks in its successful operation. Some of these barriers have the potential to even disrupt the operation of the project activity thereby damaging the commercial viability of the project activity.

Before implementation of the project activity CPM considered the barriers to the implementation of the same. CPM's management discussed various aspects of project activity implementation. The management finally took the decision of taking the investment risks and secure financing through internal accruals so as to invest in the CDM project activity after computing approximately the expected revenues that can be generated through the CDM route. The corporate decision to invest

- in overcoming the barriers encountered in the project activity implementation
- in the CDM project activity

has been guided by the anthropogenic greenhouse gas emission reductions the project activity would result in and the associated carbon financing the project activity would receive through sale of Certified Emission Reductions under the Clean Development Mechanism. Further with CDM project activity registration many more paper mills in India would take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reduction.

B.6. Emission Reductions:

B.6.1. Explanation of methodological choices:

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Project activity emissions are the emissions corresponding to fossil fuel (coal) based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam, in HP steam generation from the cogeneration plant, in MP steam consumption for soot-blowing in the chemical recovery boiler and in the jet ejector system of the evaporator plant in the project activity scenario. Baseline emissions are the emissions corresponding to fossil fuel (coal) based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam, in HP steam generation from the cogeneration plant and in MP steam consumption for soot-blowing in the chemical recovery boiler and in the jet ejector system of the evaporator plant in the baseline scenario.

<u>Description of formulae used to estimate project emissions</u>

Fossil fuel (coal) based thermal energy consumption in the project scenario is given by:

$$E_{th,y} = E_{LP,y} + E_{HP,y} + E_{MP,y}$$

Where,

$E_{th,y}$ – Coal based thermal energy consumption in the project boundary in the project scenario (GWh)

y is any year in the crediting period

$E_{LP,y}$ **-** Coal based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam in the project scenario (GWh)

$E_{HP, y}$ - Coal based thermal energy consumption in HP steam generation from the cogeneration plant in the project scenario (GWh)

$E_{MP, y}$ - Coal based thermal energy consumption through use of MP steam as motive fluid in the steam jet ejector system of the evaporator plant and also for the purpose of soot blowing in the chemical recovery boiler in the project scenario (GWh)

Estimation of coal based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam in the project activity scenario

LP steam used in CPM, is obtained mainly through extraction of LP steam from the two turbines. HP steam is generated in the cogeneration plant of CPM, in three coal fired boilers and a chemical recovery boiler. Since chemical recovery boiler uses black liquor as fuel and production of black liquor is intimately related to the throughput of the plant, therefore in a situation of lesser requirement of HP steam generation as has happened through reduced LP steam consumption in the evaporator plant, the reduction will happen in the generation from the coal fired boilers, thereby reducing the coal combustion in the cogeneration plant. Therefore, any change in the consumption pattern of LP steam in CPM, will result in reduction in an equivalent quantity of HP steam generation from the coal fired boilers of the cogeneration plant.

$$E_{LP,y} = \frac{A_{LP,y}}{\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y} \cdot 0.278$$

Where,

$A_{LP,y}$ – Amount of LP steam consumed in the evaporator plant in the project activity scenario (MT)

$\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y$ - Average amount of HP steam generated (in MT) from the coal fired boilers per TJ of coal based thermal energy consumption corresponding to coal fired in the coal fired boilers in a year y in the project activity scenario

Estimation of coal based thermal energy consumption in HP steam generation from the cogeneration plant in the project activity scenario

Installation of FFFF evaporator as the finisher evaporator, has resulted in an increase in the solid concentration of black liquor coming out of the mixed feed arrangement of the evaporator plant. Increased black liquor solids firing has resulted in higher quantity of HP steam generation from the chemical recovery boilers. Since chemical recovery boiler uses black liquor as fuel and production of black liquor is intimately related to the throughput of the plant, therefore any change in the generation pattern of HP steam from the chemical recovery boiler, will result in reduction in an equivalent quantity of HP steam generation from the coal fired boilers of the cogeneration plant.

$$E_{HP,y} = E_{coal\_CFB,y} \cdot 0.278$$

Where,

$E_{coal\_CFB,\ y}$ – Thermal energy consumption corresponding to coal combusted in the coal fired boilers of the cogeneration plant of CPM in the project activity scenario (TJ)

Estimation of coal based thermal energy consumption through use of MP steam as motive fluid for creating vacuum in the evaporator plant using steam jet ejector system and also for the purpose of soot blowing in the chemical recovery boiler in the project scenario

$$E_{MP,y} = E_{MP\_SJE,y} + E_{MP\_SB,y}$$

Where,

$E_{MP\_SJE,\ y}$ - Coal based thermal energy consumption through use of MP steam as motive fluid in the steam jet ejector system of the evaporator plant in a year y in the project scenario (GWh)

$E_{MP\_SB,\ y}$ - Coal based thermal energy consumption through use of MP steam for the purpose of soot blowing in the chemical recovery boiler in a year y in the project scenario (GWh)

MP steam used as motive fluid in the steam jet ejector system of the evaporator plant, is made available by letting down the pressure of HP steam and de-superheating it through injection of water in a pressure reducing de-superheating (PRDS) system. Therefore any change in the consumption pattern of MP steam in steam jet ejector system of the evaporator plant, will result in reduction in a certain quantity of HP steam generation from the coal fired boilers of the cogeneration plant.

$$E_{MP\_SJE,y} = \frac{A_{MP\_SJE,y}}{\left(\frac{A_{MP}}{A_{HP}}\right)_y} \cdot \frac{1}{\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y} \cdot 0.278$$

Where,

$A_{MP\_SJE,\ y}$ – Amount of MP steam consumed as motive fluid in the steam jet ejector system of the evaporator plant in the project activity scenario (MT)

$\left(\frac{A_{MP}}{A_{HP}}\right)_y$ - Average amount of MP steam generated (in MT) by letting down and de-superheating of HP steam in the PRDS system in a year y in the project activity scenario.

MP steam used for the purpose of soot-blowing in the chemical recovery boiler, is made available by letting down the pressure of HP steam. Therefore any change in the consumption pattern of MP steam in the soot-blowers of the chemical recovery boiler, will result in reduction in a certain quantity of HP steam generation from the coal fired boilers of the cogeneration plant.

$$E_{MP\_SB,y} = \frac{A_{MP\_SB,y}}{\left(\frac{H_{SB}}{H_{HP}}\right)} \cdot \frac{1}{\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y} \cdot 0.278$$

Where,

$A_{MP\_SB,\ y}$ – Amount of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler in the project activity scenario (MT)

H_{SB} – Specific enthalpy of steam used for the purpose of soot blowing in the chemical recovery boiler (in kJ/kg)

H_{HP} – Average specific enthalpy of HP steam generated in the coal fired boilers of CPM (in kJ/kg)

Therefore, project emissions (PE_y) are given by:

$$PE_y = E_{th,y} \times EF_{coal}$$

Where,

EF_{coal} – Emission factor of coal consumed in the cogeneration plant of CPM, calculated as follows:

$$EF_{coal} = \frac{C_{coal} \cdot \left(\frac{44}{12}\right)}{NCV_{coal}}$$

Where,

C_{coal} – Total carbon percentage of the coal used in the cogeneration plant of CPM (in %)

NCV_{coal} – Net calorific value of the coal used in the cogeneration plant of CPM (in GWh/MT)

<u>Description of formulae used to estimate baseline emissions</u>

Fossil fuel (coal) based thermal energy consumption in the baseline scenario is given by:

$$E_{th,b} = E_{LP,b} + E_{HP,b} + E_{MP,b}$$

Where,

$E_{th,\ b}$ – Coal based thermal energy consumption in the project boundary in the baseline scenario (GWh)

$E_{LP,\ b}$ - Coal based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam in the baseline scenario (GWh)

$E_{HP,\ b}$ - Coal based thermal energy consumption in HP steam generation from the cogeneration plant in the baseline scenario (GWh)

$E_{MP,\ b}$ - Coal based thermal energy consumption through use of MP steam as motive fluid in the steam jet ejector system of the evaporator plant and also for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario (GWh)

Estimation of coal based thermal energy consumption in concentration of weak black liquor through evaporation using LP steam in the baseline scenario

$$E_{LP,b} = \frac{\left(\frac{A_{LP,b}}{A_{WBL,b}}\right)}{\left(\frac{A_{HP\_CFB,y}}{E_{coal\_CFB,y}}\right)} \cdot A_{WBL,y} \cdot 0.278$$

Where,

$\left(\frac{A_{LP,b}}{A_{WBL,b}}\right)$ – Average amount of LP steam consumed (in MT) per MT amount of weak black liquor processed in the evaporator plant in the baseline scenario

$A_{WBL,y}$ – Amount of weak black liquor processed in the evaporator plant in a year y in the project activity scenario (MT)

Estimation of coal based thermal energy consumption in HP steam generation from the cogeneration plant in the baseline scenario

$$E_{HP,b} = \left[\frac{E_{coal\_CFB,b}}{A_{HP\_CFB,b} + A_{HP\_CRB,b} \times \left(\frac{A_{WBL,y}}{A_{WBL,b}}\right)}\right] \cdot A_{HP\_cogen,y} \cdot 0.278$$

Where,

$E_{coal\_CFB,b}$– Thermal energy consumption corresponding to coal (in TJ) combusted in the coal fired boilers of the cogeneration plant of CPM in the baseline scenario

$A_{HP\_CFB,b}$ - Amount of HP steam generated from the coal fired boilers of the cogeneration plant of CPM in the baseline scenario (in MT)

$A_{HP\_CRB,b}$ - Amount of HP steam generated from the chemical recovery boiler of the cogeneration plant of CPM in the baseline scenario (in MT)

Estimation of coal based thermal energy consumption through use of MP steam as motive fluid for creating vacuum in the evaporator plant using steam jet ejector system and also for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario

$$E_{MP,b} = E_{MP\_SJE,b} + E_{MP\_SB,b}$$

Where,

$E_{MP\_SJE,\ b}$ - Coal based thermal energy consumption through use of MP steam as motive fluid in the steam jet ejector system of the evaporator plant in the baseline scenario (GWh)

$E_{MP\_SB,\ b}$ - Coal based thermal energy consumption through use of MP steam for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario (GWh)

$$E_{MP\_SJE,b} = \frac{\left(\frac{A_{MP\_SJE}}{A_{WBL}}\right)_b}{\left(\frac{A_{MP}}{A_{HP}}\right)_b} \cdot \frac{1}{\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y} \cdot A_{WBL,y} \cdot 0.278$$

Where,

$\left(\frac{A_{MP\_SJE}}{A_{WBL}}\right)_b$ – Average amount of MP steam consumed as motive fluid in the steam jet ejector system of the evaporator plant per m^3 of weak black liquor processed in the baseline scenario (MT)

$\left(\frac{A_{MP}}{A_{HP}}\right)_b$ - Average amount of MP steam generated (in MT) by letting down and de-superheating of HP steam in the PRDS system in the baseline scenario.

$$E_{MP\_SB,b} = \frac{A_{MP\_SB,b}}{\left(\frac{H_{SB}}{H_{HP}}\right)} \cdot \frac{1}{\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y} \cdot A_{HP\_CRB,y} \cdot 0.278$$

Where,

$A_{MP\_SB,b}$ – Amount of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario (in MT)

Therefore, baseline emissions (BE_y) are given by:

$$BE_y = E_{th,b} \times EF_{coal}$$

Description of formulae used to estimate energy savings

Thermal energy savings ($E_{s, th, y}$) due to the project activity is given by

$E_{s, th, y} = E_{th, y} – E_{th, b}$

Leakage - Direct off-site emissions

As per paragraph 5 of Appendix B of Category II.D (Version 09, EB 31, Sectoral Scope 04,) small scale methodologies, "*if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered*". For the project activity under consideration, the energy efficient technology includes the replacement of the existing finisher evaporator which was a cascade evaporator, with a new FFFF evaporator and also addition of new economizer banks in the chemical recovery boiler. During the installation of the FFFF evaporator, the cascade evaporator was completely scrapped and then sold off. Therefore, there was no opportunity for utilization of the cascade evaporator elsewhere after removal from the evaporator plant.

So, leakage (L_y) = 0

Description of formulae used to estimate emission reductions

$$ER_y = BE_y - PE_y - L_y = BE_y - PE_y - 0 = BE_y - PE_y$$

ER_y= Emission reductions arising out of the project activity (tonnes of CO_2 e)

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

Data / Parameter:	$\left(\frac{A_{LP,b}}{A_{WBL,b}}\right)$
Data unit:	Dimensionless
Description:	Weighted average amount of LP steam consumed (in MT) per MT of weak black liquor processed in the evaporator plant in the baseline scenario
Source of data used:	Log books maintained by the chemical recovery boiler unit of CPM
Value applied:	0.18
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. Amount of weak black liquor concentrated in the evaporator plant was measured on an hourly basis by a volumetric flow meter at the inlet of the evaporator plant and recorded in the log-book maintained by the chemical recovery boiler. In base line scenario, figures are given in MT by multiplying volumetric flow with average WBL density of 1.05 MT/m^3 at 17% concentration as no mass flow meter was there in the pre-project scenario. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of weak black liquor concentrated in the evaporator plant in the baseline scenario. Similarly amount of LP steam consumed in the evaporator plant is measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of LP steam consumption in the evaporator plant in the baseline scenario. $\left(\frac{A_{LP}}{A_{WBL}}\right)_b$ is calculated as the ratio of the annual value of LP

	steam consumed (in MT) and that of weak black liquor processed in the evaporator plant (in MT) in the baseline scenario.
Any comment:	

Data / Parameter:	$A_{coal\_CFB,\ b}$
Data unit:	MT
Description:	Amount of coal combusted in the coal fired boilers of the cogeneration plant of CPM in the baseline scenario
Source of data used:	Log books maintained by the utility department of CPM
Value applied:	183556
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. Amount of coal fed into each of the three coal fired boilers was measured by load cells installed on the coal bunkers and recorded on a daily basis in the log-book maintained by the utility department. The data was verified against the dip-stick measurements taken at each of the coal feeders. The daily values for each coal fired boiler, were added up to yield the daily values of total coal consumption in the cogeneration plant which in turn were added up to generate the annual value of coal combusted in the coal fired boilers in the baseline scenario.
Any comment:	

Data / Parameter:	$E_{coal\_CFB,\ b}$
Data unit:	TJ
Description:	Thermal energy consumption (in TJ) corresponding to coal combusted in the coal fired boilers of the cogeneration plant of CPM in the baseline scenario
Source of data used:	Log books maintained by the utility department of CPM
Value applied:	3457.64
Justification of the choice	For emission reduction estimation, the baseline data for the year from November 2003 to

of data or description of measurement methods and procedures actually applied :	October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. The annual value of coal combusted in the coal fired boilers in the baseline scenario, was multiplied with NCVcoal to yield $E_{coal\_CFB ,b}$.
Any comment:	

Data / Parameter:	$A_{HP\_CFB, b}$
Data unit:	MT
Description:	Amount of HP steam generated from the coal fired boilers of the cogeneration plant of CPM in the baseline scenario
Source of data used:	Log books maintained by the utility department of CPM
Value applied:	1191466
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. Amount of HP steam generated from each of the coal fired boilers was measured on an hourly basis and recorded in the log-book maintained by the utility department. The shift wise values were added up to yield the daily values which in turn were added up to generate the annual value of HP steam generation from each of the coal fired boilers. Sum of the annual values of HP steam generation from all the coal boilers yielded $A_{HP\_CFB, b}$
Any comment:	

Data / Parameter:	$A_{HP\_CRB, b}$
Data unit:	MT
Description:	Amount of HP steam generated from the chemical recovery boiler of CPM in the baseline scenario
Source of data used:	Log books maintained by the utility department of CPM
Value applied:	330047
Justification of the choice of data or description of	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for

measurement methods and procedures actually applied :	details. The amount of HP steam generated from the chemical recovery boiler was measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler unit. The shift wise values were added up to yield the daily values which in turn were added up to generate the annual value of HP steam generation from the chemical recovery boiler.
Any comment:	

Data / Parameter:	$\left(\frac{A_{MP\_SJE}}{A_{WBL}}\right)_b$
Data unit:	Dimensionless
Description:	Weighted average amount of MP steam consumed as motive fluid in the steam jet ejector system of the evaporator plant per MT of weak black liquor processed in the baseline scenario
Source of data used:	Log books maintained by the evaporator plant of CPM
Value applied:	0.0032
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. Amount of weak black liquor concentrated in the evaporator plant was measured on an hourly basis by a volumetric flow meter at the inlet of the evaporator plant and recorded in the log-book maintained by the chemical recovery boiler. In base line scenario, figures are given in MT by multiplying volumetric flow with average WBL density of 1.05 MT/m^3 at 17% concentration as no mass flow meter was there in the pre-project scenario. The shift wise values were added up to yield the daily values which in turn were added up to generate the annual value of weak black liquor concentrated in the evaporator plant in the baseline scenario. Similarly amount of MP steam consumed in the steam jet ejector system of the evaporator plant was measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values were added up to yield the daily values which in turn were added up to generate the annual value of MP steam consumption for vacuum creation in the evaporator plant in the

	baseline scenario. $\left(\frac{A_{MP\_SJE}}{A_{WBL}}\right)_b$ was calculated as the ratio of the annual value of MP steam consumed for vacuum creation (in MT) and that of weak black liquor processed in the evaporator plant (in MT)in the baseline scenario.
Any comment:	

Data / Parameter:	$\left(\frac{A_{MP}}{A_{HP}}\right)_b$
Data unit:	Dimensionless
Description:	Average amount of MP steam generated (in MT) by letting down and de-superheating of HP steam in the PRDS system in the baseline scenario.
Source of data used:	Calculated as per the records maintained by CPM
Value applied:	1.1364
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. $\left(\frac{A_{MP}}{A_{HP}}\right)_y$ has been taken to be equal to $\left(\frac{A_{MP}}{A_{HP}}\right)_b$ and will be kept constant for the entire crediting period.
Any comment:	

Data / Parameter:	$A_{MP\_SB,\ b}$
Data unit:	MT
Description:	Amount of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario
Source of data used:	Log books maintained by the evaporator plant of CPM

Value applied:	13792.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Please refer to Annex 3: Baseline Information for details. Amount of steam consumed for the purpose of steam blowing in the chemical recovery boiler was measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values were added up to yield the daily values which in turn were added up to generate the annual value of MP steam consumption for soot blowing in the chemical recovery boiler in the baseline scenario.
Any comment:	

Data / Parameter:	H_{SB}
Data unit:	kJ/kg
Description:	Enthalpy of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler in the baseline scenario
Source of data used:	The enthalpy was calculated on the basis of average temperature of 300 ^{O}C and pressure of 19 kg/cm^2 of steam used for the purpose of soot blowing in the chemical recovery boiler.
Value applied:	3026.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Temperature and pressure of soot-blowing steam was measured on a regular basis in the baseline scenario. Averages of the temperature and pressure values have been used for the purpose of estimating the enthalpy of the MP steam used for the purpose of soot-blowing.
Any comment:	H_{SB} has been calculated ex-ante and will be kept constant for the entire crediting period

Data / Parameter:	H_{HP}
Data unit:	kJ/kg
Description:	Average enthalpy of HP steam generated from the coal fired boilers of CPM in the baseline scenario
Source of data used:	The enthalpy was calculated on the basis of average temperature of 400 ^{O}C and pressure

	of 60 kg/cm^2 of HP steam generated from the coal fired boilers of CPM.
Value applied:	3179.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	For emission reduction estimation, the baseline data for the year from November 2003 to October 2004 have been considered. Temperature and pressure of HP steam was measured on an hourly basis in the baseline scenario. Averages of the temperature and pressure values have been used for the purpose of estimating the enthalpy of the HP steam generation from the coal fired boilers of CPM.
Any comment:	H_{HP} has been calculated ex-ante and will be kept constant for the entire crediting period

B.6.3. Ex-ante calculation of emission reductions:

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Emission Reductions from increased steam economy	
Baseline LP steam consumption in evaporation plant	160427.77
LP steam consumption data in evaporation plant (in MT) in project scenario	182173.00
Parameters	Quantity
LP steam consumed in evaporation plant in the baseline scenario (MT)	160427.77
WBL processed in evaporator plant in baseline scenario in MT	875658.85
Specific LP steam consumption in baseline scenario (MT of LP steam used in evaporator plant/MT of WBL processed)	0.18
WBL processed in evaporator plant in project scenario in MT	1181126.00
HP steam corresponding to LP steam consumed in the evaporator plant (in MT)	216391.82
HP steam from the coal fired boilers to coal based thermal energy consumption ratio in the project scenario (MT/TJ)	355.51
Coal based thermal energy consumption in the HP steam generation from the coal fired boilers in the baseline scenario (in TJ)	608.68

$E_{LP,b}$ (in GWh)	169.21
LP steam consumed in evaporation plant in the project scenario (MT)	182173.00
HP steam from the coal fired boilers to coal based thermal energy consumption ratio in the baseline scenario (MT/TJ)	355.51
Coal based thermal energy consumption in the HP steam generation from the coal fired boilers in the baseline scenario (in TJ)	512.42
$E_{LP,y}$ (in GWh)	142.45
Thermal energy savings due to reduced LP steam consumption in the evaporator plant (in GWh)	26.76
Emission factor of coal used in the cogeneration plant of CPM (in t CO_2/GWh)	345.68
CO_2 emission reductions due to reduction in coal-based steam consumption in evaporator plant (tonnes/annum)	9249.84
Emission Reductions due to greater steam economy obtained after FFFE	**9249.84**

Emission Reductions from increased HP steam generation from chemical recovery boiler	
Baseline Scenario	**Quantity**
Average coal based thermal energy consumption (in TJ) per MT of HP steam generation from the cogeneration plant in the baseline scenario	0.002112638
HP steam generation from the cogeneration plant in the project scenario (in MT)	1737852.00
Coal based thermal energy consumption in the cogeneration plant of CPM in the baseline scenario (in TJ)	3671.45
$E_{HP,b}$ (in GWh)	1020.66
Project Scenario	Quantity
Coal based thermal energy consumption (in TJ) in the cogeneration plant in the project scenario	3419.78
$E_{HP,y}$ (in GWh)	950.70

Thermal energy savings due to increased HP steam generation from the chemical recovery boiler (in GWh)	69.96
Emission factor of coal used in the cogeneration plant of CPM (in t CO2/GWh)	345.68
Emission Reductions due to higher steam generation from the CRB	**24185.58**

Period	**Steam (in MT) used for the purpose of soot-blowing in the chemical recovery boiler**
Steam consumed for soot-blowing in the chemical recovery boiler in the period Nov 2003-Oct 2004	13666.497
Average soot-blowing steam to HP steam ratio in the cogeneration plant of CPM (in MT/MT)	**0.95**
HP steam corresponding to soot blowing steam used in the chemical recovery boiler (in MT)	**14357.32**
Average HP steam generation from the coal fired boilers wrt coal based thermal energy consumption in the same in the project scenario (in MT/TJ)	**355.51**
Coal based thermal energy consumption corresponding to soot blowing steam used in the chemical recovery boiler (in TJ)	**40.38**
$E_{MP\_SB,b}$ (in GWh)	**11.23**
Period	**MP steam (in MT) used for the purpose of soot-blowing in the chemical recovery boiler**
Steam consumed for soot-blowing in the chemical recovery boiler in the period Nov 2004-Oct 2005	37662.04
Average soot-blowing steam to HP steam ratio in the cogeneration plant of CPM (in MT/MT)	**0.95**
HP steam corresponding to soot blowing steam used in the chemical recovery boiler (in MT)	**39565.80**

Average HP steam generation from the coal fired boilers wrt coal based thermal energy consumption in the same in the project scenario (in MT/TJ)	**355.51**
Coal based thermal energy consumption corresponding to soot blowing steam used in the chemical recovery boiler (in TJ)	**111.29**
$E_{MP\_SB,y}$ (in GWh)	**30.94**
Thermal energy increment due to increased soot blowing steam requirement (in GWh)	**19.71**
Emission factor of coal used in the cogeneration plant of CPM (in t CO_2/GWh)	**345.68**
Project activity emissions due to increased soot blowing steam requirement in the CRB (in t CO_2 e)	**6814.22**

Project activity emissions due to increased consumption of MP steam in the ejector of the evaporator plant			
Period	**MP steam (in MT) used in ejector system of evaporator plant**	**Weak black liquor (WBL) processed in the evaporator plant (in MT)**	**Specific MP steam consumption in ejector system wrt WBL processed**
Nov 2003-Oct 2004	2727.94	875658.85	0.0031
Average specific MP steam consumption in ejector system of evaporator plant wrt WBL processed in the baseline scenario			0.0031
WBL processed in the evaporator plant in the project scenario (in MT)			1181126.00
MP steam consumption in ejector system of evaporator plant in the baseline scenario (in MT)			3679.56
Average MP steam to HP steam ratio (in MT/MT)			1.1364
HP steam corresponding to MP used in the ejector system of the evaporator plant (in MT)			3237.82
Average HP steam generation from the coal fired boilers wrt coal based thermal energy consumption in the same in the project scenario (in MT/TJ)			355.51
Coal based thermal energy consumption corresponding to MP steam used in the ejector of the evaporator plant (in TJ)			9.11

$E_{MP\_SJE,b}$ (in GWh)	2.53

Period	MP steam (in MT) used in ejector system of evaporator plant	WBL processed in the evaporator plant (in MT)	Specific MP steam consumption in ejector system wrt WBL processed D5
Nov 2004-Oct 2005	7702.81	1181126.00	0.0065
Average MP steam consumption in ejector system of evaporator plant in the project scenario (in MT)			7702.81
Average MP steam to HP steam ratio (in MT/MT)			1.1364
HP steam corresponding to MP steam used in the ejector system of the evaporator plant (in MT)			6778.89
Average HP steam generation from the coal fired boilers wrt coal based thermal energy consumption in the same in the project scenario (in MT/TJ)			355.51
Coal based thermal energy consumption corresponding to MP steam used in the ejector of the evaporator plant (in TJ)			19.07
$E_{MP\_SJE,y}$ (in GWh)			5.30
Thermal energy increment due to increased MP steam requirement for vacuum creation in evaporator plant (in GWh)			2.77
Emission factor of coal used in the cogeneration plant of CPM (in t CO2/GWh)			345.68
Project activity emissions due to increased MP steam requirement for vacuum creation in evaporator plant (in t CO_2 e)			**956.98**

Parameters	Quantity
CO_2 emission reductions due to reduction in coal-based steam consumption in evaporator plant (tonnes/annum)	9249.84
CO_2 emission reductions due to reduction in coal-based steam generation from the cogeneration plant (tonnes/annum)	24185.58
Baseline Emissions	33435.42
CO_2 emission increment due to higher MP steam consumption for vacuum creation in evaporator plant (tonnes/annum)	6814.22
CO_2 emission increment due to higher MP steam consumption for soot blowing in the chemical recovery boiler (tonnes/annum)	956.98
Project Emissions	7771.20
Net emission reductions from the steam optimization measure (tCO_2/annum)	**25664.22**
Emission reductions in 10 years (in t CO_2)	**256642.19**

Net Thermal Energy Savings arising out of project activity	**74.24**

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

Years	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emission reductions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO_2 e)	Annual estimation of emission reductions in tonnes of CO_2 e
August 2007- July 2008	7771.20	33435.42	0	25664.22
August 2008- July 2009	7771.20	33435.42	0	25664.22
August 2009- July 2010	7771.20	33435.42	0	25664.22
August 2010- July 2011	7771.20	33435.42	0	25664.22
August 2011- July 2012	7771.20	33435.42	0	25664.22
August 2012- July 2013	7771.20	33435.42	0	25664.22

August 2013- July 2014	7771.20	33435.42	0	25664.22
August 2014- July 2015	7771.20	33435.42	0	25664.22
August 2015- July 2016	7771.20	33435.42	0	25664.22
August 2016- July 2017	7771.20	33435.42	0	25664.22
Total estimated reductions (tonnes of CO_2 e)	**77712.0**	**33435.42**	**0**	**256642.2**

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

>>

Title: Monitoring Methodology for – ***Energy efficiency and fuel switching measures for industrial facilities***

Reference: Paragraphs 6 and 7 of Category II.D as provided in Appendix B of the Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories.

As per the provisions of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21] the "Project participants may use the **simplified baseline and monitoring methodologies specified in appendix B** for their project category" if they meet the applicability criteria of Small scale CDM project activity. Since the project activity is a small-scale project of a new energy efficient facility classifiable under II.D category the monitoring methodology and plan has been developed in line with the guidance provided in Paragraphs 7 and 8 of Category II.D, Appendix B.

Description of Monitoring Methodology:

According to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, the project has been identified to belong to Category II.D [Energy efficiency and fuel switching measures for industrial facilities]. Paragraph 7 and 8 under Category II.D of the same document specify that for the said category of CDM projects, 'In the case of replacement, modification and retrofit measures the monitoring shall consist of:

(a) Documenting the specifications of the equipment replaced;

(b) Metering the energy use of the industrial facility, processes or the equipment affected by the project activity;

(c) Calculating the energy savings using the metered energy obtained from subparagraph (b).

In the case of a new facility, monitoring shall consist of:

(a) Metering the energy use of the equipment installed;

(b) Calculating the energy savings due to the equipment installed.'

The project activity under consideration consists of replacement of the cascade evaporator with a FFFF evaporator as the finisher evaporator and also retrofitting of the chemical recovery boilers through addition of economizers. As per paragraph 6 and 7 under Category II.D of Appendix B of the simplified M&P for small-scale CDM project activities, monitoring plan of the project activity should include the coal based thermal energy consumption in the process of evaporation of the weak black liquor for concentration, coal based thermal energy consumption in HP steam generation in the cogeneration plant of CPM and fossil fuel based electrical energy consumption corresponding to electricity consumption in the evaporator plant-chemical recovery boiler system.

B.7.1. Data and parameters monitored:

>>

Technical specifications of the modifications made under the project activity

<u>Additional economizers in the boiler</u>

Type of economizer - three stage vertical panel economiser of axial flow type.

Area – 4900 m^2

Design - outlet flue gas temperature of 185 °C at 515 total dissolved solids (TDS) /day

<u>Free flow falling film evaporator specifications</u>

No.of bodies	3
Shell diameter	3 100 mm
Shell thickness	10 mm

Shell material	SS304
Cylindrical height	9000 mm
Total height	11000 mm
Lamella area	945 m^2 / body
No. of Lamella	54
Height of Lamella	7315 mm
Width of Lamella	1219 mm
Lamella material	SS 2333
Lamella plate thickness	1.5 mm

External pre-heater specifications

No of preheaters	4
Height of shell	5010mm
Diameter of shell	890 mm
Shell thickness	10mm
Tubes sheet thickness	10 mm
Tube length	5010 mm
Tube outside diameter	42 mm
Tube thickness	1.6 mm
No. of tubes per heater	108
Tube material	SS304 L
No. of passes on tube side	6
Heating Area	80 m^2/ preheater

DESCRIPTION	UNIT	VALUE
WBL FEED		
Flow	T/HR	171.6
Concentration	% T.S	12.5
Temperature	^oC	85

PRODUCT LIQUOR

Flow	T/HR	30.6
Concentration	% T.S	70
Temperature	^{o}C	107.8

L.P. STEAM

Flow	T/HR	27
Pressure	$kg/cm^2(g)$	3.0
Temperature	^{o}C	142
Steam Economy		5.22
(with 6 effect operation)		
Water evaporation	MTPH	141

Surface condenser specifications

Length	mm	4256
Condenser cooling water flow	m^3/hr	1572
Inlet water temperature	^{o}C	35
Outlet water temperature	^{o}C	45

Primary Condensate

Flow	T/HR	24.17
Temperature	^{o}C	82.8

Secondary Condensate

Flow	T/HR	114.9
Temperature	^{o}C	71.5

Data / Parameter:	**$A_{LP,y}$**
Data unit:	MT
Description:	Amount of LP steam consumed in the evaporator plant in the project activity scenario
Source of data to be used:	Log books maintained by the chemical recovery boiler unit of CPM

<table>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-
<table>
<tr><th>Months</th><th>Nov04-Oct05</th></tr>
<tr><td>Nov</td><td>15358</td></tr>
<tr><td>Dec</td><td>16348</td></tr>
<tr><td>Jan</td><td>16107</td></tr>
<tr><td>Feb</td><td>15813</td></tr>
<tr><td>Mar</td><td>16941</td></tr>
<tr><td>Apr</td><td>14021</td></tr>
<tr><td>May</td><td>18231</td></tr>
<tr><td>Jun</td><td>16019</td></tr>
<tr><td>Jul</td><td>15761</td></tr>
<tr><td>Aug</td><td>15091</td></tr>
<tr><td>Sept</td><td>14961</td></tr>
<tr><td>Oct</td><td>7522</td></tr>
<tr><td>Total LP steam consumption in evaporator plant (in MT)</td><td>182173</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Amount of LP steam consumed in the evaporator plant is measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of LP steam consumption in the evaporator plant in a particular year.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the chemical recovery boiler unit would be responsible for checking of the data on an annual basis</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	$\mathbf{A_{HP\_CFB,y}}$
Data unit:	MT
Description:	Amount of HP steam generated from the coal fired boilers of the cogeneration plant in a year y in the project activity scenario
Source of data to be used:	Log books maintained by the chemical recovery boiler unit of CPM

Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-

Period	Quantity
NOVEMBER	96418.00
DECEMBER	99260.00
JANUARY	116381.00
FEBRUARY	106706.00
MARCH	115748.00
APRIL	98863.00
MAY	97722.00
JUNE	106155.00
JULY	104064.00
AUGUST	99392.00
SEPTEMBER	106559.00
OCTOBER	68505.00
Annual Figures	1215773.00

Description of measurement methods and procedures to be applied:	Amount of HP steam generated from each of the coal fired boilers is measured on an hourly basis and recorded in the log-book maintained by the utility department. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of HP steam generation from each coal fired boiler. Sum of the annual values of HP steam generation from all the coal fired boilers yield the annual value of HP steam generation from the cogeneration plant in the project activity scenario.
QA/QC procedures to be applied:	Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the utility would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	$A_{coal\_CFB,y}$
Data unit:	MT
Description:	Total amount of coal combusted in the coal fired boilers of the cogeneration plant in a

<table>
<tr><td></td><td>year y in the project activity scenario</td></tr>
<tr><td>Source of data to be used:</td><td>Log books maintained by the utility department of CPM</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-

<table>
<tr><th>Period</th><th>Quantity</th></tr>
<tr><td>NOVEMBER</td><td>13945.00</td></tr>
<tr><td>DECEMBER</td><td>14174.00</td></tr>
<tr><td>JANUARY</td><td>16400.00</td></tr>
<tr><td>FEBRUARY</td><td>15239.00</td></tr>
<tr><td>MARCH</td><td>16510.00</td></tr>
<tr><td>APRIL</td><td>14150.00</td></tr>
<tr><td>MAY</td><td>14077.00</td></tr>
<tr><td>JUNE</td><td>15453.00</td></tr>
<tr><td>JULY</td><td>16715.00</td></tr>
<tr><td>AUGUST</td><td>15583.00</td></tr>
<tr><td>SEPTEMBER</td><td>16764.00</td></tr>
<tr><td>OCTOBER</td><td>12536.00</td></tr>
<tr><td>Annual Figures</td><td>181546.00</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Amount of coal fed into each of the three coal fired boilers is measured by load cells installed on the coal bunkers and recorded on a daily basis in the log-book maintained by the utility department. The data is verified against the dip-stick measurements taken at each of the coal feeders. The daily values for each coal fired boiler, are added up to yield the daily values of total coal consumption in the cogeneration plant which in turn are added up to generate the annual value of coal combusted in the coal fired boilers in the project scenario.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the utility department would be responsible for checking of the data on an annual basis</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	**NCV_{coal}**
Data unit:	GWh/MT
Description:	Average net calorific value of coal used in the cogeneration plant of CPM in the project activity scenario
Source of data to be used:	Coal sample analysis reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the purpose of calculating expected emission reductions in Section B.5, Table 1.2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been referred to and the default value of 4500 kCal/kg i.e. 0.0052 GWh/MT has been used.
Description of measurement methods and procedures to be applied:	Coal used in the cogeneration plant of CPM is procured from the coalfields of Meghalaya and North Eastern Coalfields, which is of sub-bituminous type. Sample analysis of the coal used in CPM, will be done on a bi-annual basis. Average of the net calorific values obtained through sample analysis of coal, will be considered as NCV_{coal}
QA/QC procedures to be applied:	Manager In-charge of the utility department would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	**C_{coal}**
Data unit:	%
Description:	Total carbon percentage of coal used in the cogeneration plant of CPM in the project activity scenario
Source of data to be used:	Coal sample analysis reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the purpose of calculating expected emission reductions in Section B.5, Table 1.3 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been referred to and the default value of 26.2 kg/GJ for the carbon emission factor of sub-bituminous type coal, has been used. The value considered yields an emission factor of 345.68 t CO_2/GWh for the coal used in the cogeneration plant of CPM.
Description of	Coal used in the cogeneration plant of CPM is procured from the coalfields of Meghalaya

measurement methods and procedures to be applied:	and North Eastern Coalfields, which is of sub-bituminous type. Sample analysis of the coal used in CPM, will be done on a bi-annual basis. Average of the total carbon percentages obtained through sample analysis of coal, will be considered as C_{coal}
QA/QC procedures to be applied:	Manager In-charge of the utility department would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	$\mathbf{E_{coal\_CFB,y}}$
Data unit:	TJ
Description:	Thermal energy consumption corresponding to coal combusted in the coal fired boilers of the cogeneration plant in a year y in the project activity scenario
Source of data to be used:	Log books maintained by the utility department of CPM

<table>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-
<table>
<tr><th>Period</th><th>Quantity</th></tr>
<tr><td>NOVEMBER</td><td>262.68</td></tr>
<tr><td>DECEMBER</td><td>267.00</td></tr>
<tr><td>JANUARY</td><td>308.93</td></tr>
<tr><td>FEBRUARY</td><td>287.06</td></tr>
<tr><td>MARCH</td><td>311.00</td></tr>
<tr><td>APRIL</td><td>266.54</td></tr>
<tr><td>MAY</td><td>265.17</td></tr>
<tr><td>JUNE</td><td>291.09</td></tr>
<tr><td>JULY</td><td>314.86</td></tr>
<tr><td>AUGUST</td><td>293.54</td></tr>
<tr><td>SEPTEMBER</td><td>315.78</td></tr>
<tr><td>OCTOBER</td><td>236.14</td></tr>
<tr><td>Annual Figures</td><td>3419.78</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Amount of coal fed into each of the three coal fired boilers is measured by load cells installed on the coal bunkers and recorded on a daily basis in the log-book maintained by the utility department. The data is verified against the dip-stick measurements taken at each of the coal feeders. The daily values for each coal fired boiler, are added up to yield the daily values of total coal consumption in the cogeneration plant which in turn are added up to generate the annual value of coal combusted in the coal fired boilers in the project scenario. The annual value of coal combusted in the coal fired boilers of CPM, are multiplied with NCV_{coal} in order to yield $E_{coal\_CFB,y}$</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the utility department would be responsible for checking of the data on an annual basis</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	$\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y$
Data unit:	MT/TJ
Description:	Weighted average amount of HP steam generated (in MT) from the coal fired boilers per TJ of thermal energy corresponding to coal fired in the coal fired boilers in a year y in the project activity scenario
Source of data to be used:	Log books maintained by the utility department of CPM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	355.51
Description of measurement methods and procedures to be applied:	Amount of coal fed into each of the three coal fired boilers is measured by load cells installed on the coal bunkers and recorded on a daily basis in the log-book maintained by the utility department. The data is verified against the dip-stick measurements taken at each of the coal feeders. The daily values for each coal fired boiler, are added up to yield the daily values of total coal consumption in the cogeneration plant which in turn are added up to generate the annual value of coal combusted in the coal fired boilers in the project scenario. The annual value of coal combusted in the coal fired boilers of CPM, will be multiplied by the average value of net calorific value of coal, found by bi-annual sample analysis of coal. However for the purpose of estimation of emission reductions, IPCC default value for net calorific value of coal has been used. Amount of HP steam generated from each of the coal fired boilers is measured on an hourly basis and recorded in the log-book maintained by the utility department. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of HP steam generation from each coal fired boiler. Sum of the annual values of HP steam generation from all the coal fired boilers yield the annual value of HP steam generation from the cogeneration plant in the project activity scenario. $\left(\frac{A_{HP\_CFB}}{E_{coal\_CFB}}\right)_y$ will be calculated as the ratio of the annual value of HP steam generation (in MT) from the coal fired boilers

	and the thermal energy corresponding to coal consumed in the cogeneration plant (in MT) in the project scenario.
QA/QC procedures to be applied:	Manager In-charge of the utility department would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	$\mathbf{A_{MP\_SJE,\,y}}$
Data unit:	MT
Description:	Amount of MP steam consumed in the steam jet ejector of the evaporator plant in the project activity scenario
Source of data to be used:	Log books maintained by the chemical recovery boiler unit of CPM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-
Description of measurement methods and procedures to be	Amount of MP steam consumed in the steam jet ejector system of the evaporator plant is measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values are added up to yield the daily values which in turn

Period	**MP steam (in MT) used in ejector system of evaporator plant**
NOVEMBER	661.49
DECEMBER	685.76
JANUARY	677.79
FEBRUARY	630.93
MARCH	685.10
APRIL	584.44
MAY	714.55
JUNE	675.10
JULY	658.60
AUGUST	623.90
SEPTEMBER	675.00
OCTOBER	430.14
Annual Figures	7702.81

applied:	are added up to generate the annual value of MP steam consumption for creating vacuum in the evaporator plant in a particular year.
QA/QC procedures to be applied:	Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the chemical recovery boiler unit would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	$\left(\frac{A_{MP}}{A_{HP}}\right)_y$
Data unit:	Dimensionless
Description:	Weighted average amount of MP steam generated (in MT) per MT amount of HP steam passed through a PRDS system in a year y in the project activity scenario
Source of data to be used:	$\left(\frac{A_{MP}}{A_{HP}}\right)_y$ has been taken to be equal to $\left(\frac{A_{MP}}{A_{HP}}\right)_b$ and will be kept constant for the entire crediting period.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.1364
Description of measurement methods and procedures to be applied:	See Annex 3: Baseline Information for details.
QA/QC procedures to be applied:	Manager In-charge of the utility department would be responsible for checking of the data on an annual basis
Any comment:	

Data / Parameter:	$\mathbf{A_{MP\_SB,\,y}}$
Data unit:	MT

<table>
<tr><td>Description:</td><td>Amount of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler in a year y in the project activity scenario</td></tr>
<tr><td>Source of data to be used:</td><td>Log books maintained by the chemical recovery boiler unit of CPM</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-
<table>
<tr><th>Period</th><th>MP steam (in MT) used for the purpose of soot-blowing in the CRB</th></tr>
<tr><td>NOVEMBER</td><td>3400.00</td></tr>
<tr><td>DECEMBER</td><td>3246.00</td></tr>
<tr><td>JANUARY</td><td>3420.30</td></tr>
<tr><td>FEBRUARY</td><td>2954.50</td></tr>
<tr><td>MARCH</td><td>3290.14</td></tr>
<tr><td>APRIL</td><td>2707.00</td></tr>
<tr><td>MAY</td><td>3266.00</td></tr>
<tr><td>JUNE</td><td>3360.00</td></tr>
<tr><td>JULY</td><td>2889.60</td></tr>
<tr><td>AUGUST</td><td>3706.50</td></tr>
<tr><td>SEPTEMBER</td><td>3564.00</td></tr>
<tr><td>OCTOBER</td><td>1858.00</td></tr>
<tr><td>Annual Figures</td><td>37662.04</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Amount of MP steam consumed for the purpose of soot blowing in the chemical recovery boiler is measured on an hourly basis and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of MP steam consumption for the purpose of soot blowing in the chemical recovery boiler in a particular year.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the chemical recovery boiler unit would be responsible for checking of the data on an annual basis</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

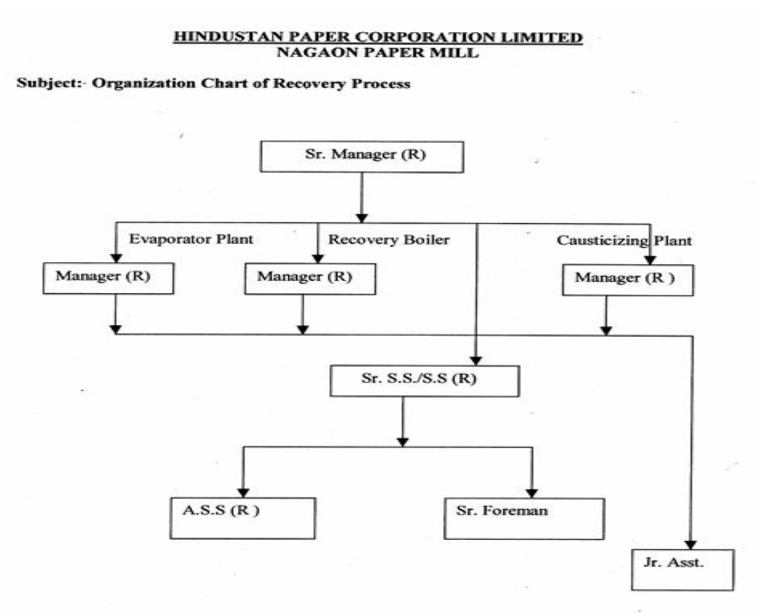
<table>
<tr><td>Data / Parameter:</td><td>$A_{WBL,y}$</td></tr>
<tr><td>Data unit:</td><td>MT</td></tr>
<tr><td>Description:</td><td>Amount of weak black liquor processed in the evaporator plant in a year y in the project activity scenario</td></tr>
<tr><td>Source of data to be used:</td><td>Log books maintained by the chemical recovery boiler unit of CPM</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>For the estimation of emission reduction, the monthly data for the year from November 2004 to October 2005 have been considered for the project activity scenario:-
<table>
<tr><th>Period</th><th>WBL processed (MT)</th></tr>
<tr><td>NOVEMBER</td><td>89753</td></tr>
<tr><td>DECEMBER</td><td>107037</td></tr>
<tr><td>JANUARY</td><td>109276</td></tr>
<tr><td>FEBRUARY</td><td>103089</td></tr>
<tr><td>MARCH</td><td>110339</td></tr>
<tr><td>APRIL</td><td>90468</td></tr>
<tr><td>MAY</td><td>114121</td></tr>
<tr><td>JUNE</td><td>103680</td></tr>
<tr><td>JULY</td><td>105224</td></tr>
<tr><td>AUGUST</td><td>97315</td></tr>
<tr><td>SEPTEMBER</td><td>99122</td></tr>
<tr><td>OCTOBER</td><td>51702</td></tr>
<tr><td>Annual Figures for project scenario</td><td>1181126</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Amount of weak black liquor concentrated in the evaporator plant will be measured on an hourly basis by a mass flow meter at the inlet of the evaporator plant and recorded in the log-book maintained by the chemical recovery boiler. The shift wise values are added up to yield the daily values which in turn are added up to generate the annual value of weak black liquor concentrated in the evaporator plant in the project scenario.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Daily data from the log-books will be retrieved and recorded in electronic form from which the monthly and annual values will be generated. Manager In-charge of the chemical recovery boiler unit would be responsible for checking of the data on an annual basis</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	Retrofit event
Data unit:	
Description:	
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Technical specifications of the retrofit events in the chemical recovery boiler and the evaporator plant will be monitored and the impact on the coal based thermal energy consumption in the cogeneration plant of CPM, will be evaluated
QA/QC procedures to be applied:	
Any comment:	Retrofit monitoring[9] is to be followed as given in the **Approved monitoring methodology AM0018: "Monitoring methodology for steam optimization systems" (Version 01,** Sectoral Scope: 3**,** 6 December 2004)

[9] **Effect of future retrofitting on baseline and project emissions:**
The following test should be applied while monitoring the effect of future retrofitting within the project boundary (change in output level, process change, equipment change *etc.* affecting specific steam consumption) on baseline and project emissions.
The following question should be asked if retrofit measures reduce the steam consumption within the project boundary.
Question: Does retrofitting reduce the steam consumption of the CDM project activity? (I.e. there is a reduction in estimated project emissions, though not caused by the CDM project activity itself.)
Action: The enhanced steam saving due to the impact of retrofit on CDM project activity needs to be estimated and deducted from claimed emission reductions.

B.7.2. Description of the monitoring plan:

Refer to Annex 4: Monitoring Plan for details. The operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity is as follows:



B.8. Duration of the baseline and monitoring methodology and the name of responsible person(s)/entity(ies):

>>

Date of completing the final draft of this baseline selection: 21/07/2007

Name of person/entity determining the baseline: Experts and consultants of CPM.

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:

18/07/2003

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

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:

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/02/2008 or the date of registration with UNFCCC, whichever is later

C.2.2.2. Length:

10 years

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 project activity is located inside the premises of the pulp and paper manufacturing plant of CPM. There has not been any significant impact on the nearest residential area or on the environment. Instead through steam optimization and related energy conservation, the project activity leads to reduced fossil fuel combustion and associated GHG emissions. Therefore, the project activity directly contributes to the global cause of mitigation of GHG emission. As per Ministry of Environment and Forests Notification, New Delhi, the 13th June, 2002, an Environment Impact Assessment (EIA) study need not be done for a project activity if the investment is less than INR 100 crore for new project and less than INR 50 crore for expansion / modernization project[10]. For the project activity at CPM, the total investment is INR 15.12 crore. Therefore, EIA was not required for this project activity. Accordingly, no separate Environment Management Plan or EIA had been developed for the project activity.

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:

Not applicable

[10] Source: EIA Notification Amendement dated June 13, 2002

SECTION E. Stakeholders' comments:

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

>>

Identification of the Stakeholders

The stakeholders identified for the project are as under:

State Pollution Control Board

The State Pollution Control Board was intimated about the details of the project activity and its likely impact on the local and global environment.

Employees of the paper mill:

The project activity has excellent local environmental impacts and the workers of the paper mill benefit from improved environmental surroundings due to emission reductions at the boiler end through implementation of energy efficient technology.

Furthermore proper managerial & technical training were imparted to managerial and operational staffs for proper and effective functioning of the system. These training programmes helped them to improve their professional skills regarding operations and maintenance of the project activity and address properly the risk issues associated with the project activity.

Local stakeholders:

Local people were intimated about the project activity and its associated environmental benefits. Local community derives direct benefit from the reduced GHG and other associated air emissions achieved through the project activity.

Consultants/ Equipment Suppliers:

Project consultants and equipment suppliers too have encouraged the project and provided full co-operation for its success.

Other Stakeholders:

Project proponent will seek public comments before registration of the project with the UNFCCC.

E.2 Summary of the comments received:

>>

Workers' Union

The officers' association appreciated the initiative of CPM towards registration of the project with United Nations Framework Convention on Climate Change (UNFCCC) for obtaining revenues under 'Clean Development Mechanism' (CDM) and commended HPC for their effort in direct reductions of GHG (CO_2) emissions by reduced energy consumption thus contributing to the overall cause of mitigation of global warming and natural resource conservation.

Local Club

A local club observed that in a developing country like India where the energy consumption scenario is dominated by the rapid growth of industrialization and urbanization, fossil fuel is expected to continue to dominate India's energy sector. However, being a non-renewable resource, conservation of fossil fuel wherever possible or changing its consumption pattern is essential. The project to be implemented by CPM will positively contribute towards reduction in use of finite natural resource coal. They appreciated the initiative of CPM as a positive step towards energy conservation and cleaner, greener environment.

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

>>

The relevant comments and important clauses mentioned in the project documents like project description were considered in the preparation of CDM project design document. Further, the CDM-PDD will be posted on the UNFCCC or validator's web site for public viewing and comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Cachar Paper Mill (CPM), Hindustan Paper Corporation Limited
Street/P.O.Box:	75 C, Park Street

Building:	
City:	Kolkata
State/Region:	West Bengal
Postfix/ZIP:	700016
Country:	India
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FAX:	+91 33 2249-7335/4996/4932
E-Mail:	
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Represented by:	
Title:	DGM (Engg.)
Salutation:	Mr.
Last Name:	Ghosh
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First Name:	N.
Department:	
Mobile:	+91 98315 51355
Direct FAX:	
Direct tel:	
Personal E-Mail:	nkghosh@hindpaper.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for this project.

Annex 3

BASELINE INFORMATION

For the estimation of emission reduction, the monthly data for the year from November 2003 to October 2004 have been considered for the baseline scenario:-

Period	LP steam consumption in the evaporator plant (in MT)	WBL processed (in MT)
NOVEMBER	17402	95153.35
DECEMBER	17341	93413
JANUARY	16411	88856.25
FEBRUARY	14750	77991
MARCH	15926	83276
APRIL	14062	81246.25
MAY	15823	79617.75
JUNE	11585	64650.75
JULY	6123	36615.25
AUGUST	10929	60227.25
SEPTEMBER	11052	62301
OCTOBER	9023.77	52311
Annual figures for baseline scenario	160427.771	875658.85

MONTH	HP STEAM MT		Total HP Steam generation from all the boilers (in MT)	Coal consumption (in MT)	Energy consumption in HP steam generation in the coal fired boilers (in TJ)
	CF BOILER	RECOVERY BOILER			
Nov 2003-Oct 2004					
NOVEMBER	118311.00	31713.00	150024.00	18374.00	346.11
DECEMBER	124266.00	29893.00	154159.00	18764.00	353.46
JANUARY	132742.00	30656.00	163398.00	18695.00	352.16
FEBRUARY	118749.00	27326.00	146075.00	17154.00	323.13
MARCH	125800.00	30107.00	155907.00	18687.00	352.01

APRIL	108330.00	30019.00	138349.00	18178.00	342.42
MAY	105221.00	32241.00	137462.00	17361.00	327.03
JUNE	74949.00	28196.00	103145.00	14487.00	272.89
JULY	50687.00	15826.00	66513.00	8015.00	150.98
AUGUST	91603.00	25847.00	117450.00	13368.00	251.81
SEPTEMBER	85341.00	26532.00	111873.00	12032.00	226.65
OCTOBER	55467.00	21691.00	77158.00	8441.00	159.00
Annual Figures	1191466	330047	1521513	183556.00	3457.64

Period	MP steam (in MT) used in ejector system of evaporator plant	WBL processed in the evaporator plant (in MT)	Specific MP steam consumption in ejector system wrt WBL processed
Nov 2003-Oct 2004			
NOVEMBER	276.80	95153.35	0.0029
DECEMBER	283.42	93413	0.0030
JANUARY	284.90	88856.25	0.0032
FEBRUARY	256.80	77991	0.0033
MARCH	257.60	83276	0.0031
APRIL	256.37	81246.25	0.0032
MAY	258.14	79617.75	0.0032
JUNE	177.11	64650.75	0.0027
JULY	114.16	36615.25	0.0031
AUGUST	199.75	60227.25	0.0033
SEPTEMBER	202.00	62301	0.0032
OCTOBER	160.90	52311	0.0031
Annual Figures	2727.94	875658.85	0.0031

Period	MP steam (in MT) used for the purpose of soot-blowing in the CRB
NOVEMBER	1305.50
DECEMBER	1541.00

JANUARY	1375.00
FEBRUARY	1321.18
MARCH	1373.82
APRIL	1162.00
MAY	1184.00
JUNE	974.00
JULY	581.00
AUGUST	861.00
SEPTEMBER	877.00
OCTOBER	1111.00
Annual Figures	13666.50

Estimation of amount of MP steam available by reducing pressure and temperature of HP through throttling and subsequent injection of water into a de-superheating section

Mass balance across the PRDS system yields:

$$A_{MP,b} = A_{HP,b} + A_{ds\_water,b}$$ …………………………Equation (1)

Enthalpy balance across the PRDS system yields:

$$A_{MP,b} \cdot H_{MP,b} = A_{HP,b} \cdot H_{HP,b} + A_{ds\_water,b} \cdot H_{ds\_water,b}$$ …………………………Equation (2)

Where,

$A_{MP,b}$ – Amount of MP steam available by letting down and de-superheating of HP steam in the baseline scenario (MT)

$A_{HP,y}$ – Amount of HP steam which is pressure reduced and de-superheated in the baseline scenario (MT)

$A_{ds\_water,y}$ – Amount of water which is injected into the PRDS system for letting down and de-superheating HP steam in the baseline scenario (MT)

$H_{MP,y}$ – Enthalpy of MP steam available by letting down and de-superheating of HP steam in the baseline scenario (MT)

$H_{HP,y}$ – Enthalpy of HP steam which is pressure reduced and de-superheated in the baseline scenario (MT)

$H_{ds\_water,y}$ – Enthalpy of water which is injected into the PRDS system for letting down and de-superheating HP steam in the baseline scenario (MT)

Solution of the Equations (1) and (2), yields:

$$\frac{A_{MP,b}}{A_{HP,b}} = \frac{H_{HP,b} - H_{ds\_water,b}}{H_{MP,b} - H_{ds\_water,b}}$$ **……………………….Equation (3)**

Where,

Enthalpy of water injected at 20 kg/cm^2 pressure and 148 deg C into the PRDS system **-** 624.2 kJ/kg

Enthalpy of MP steam at 10.5 kg/cm^2 pressure and 220 deg C **-** 2873 kJ/kg

Enthalpy of HP steam generated from the coal fired boilers of CPM, at 60.0 kg/cm^2 pressure and 400 deg C – 3179.8 kJ/kg

Therefore, $$\frac{A_{MP,b}}{A_{HP,b}} = \frac{3179.8 - 624.2}{2873 - 624.2} = 1.136$$

Annex 4

MONITORING INFORMATION

The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (*i.e.* GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on technical / efficiency / performance parameters. It also allows scope for review, scrutiny and benchmarking of all these information against reports pertaining to M & V protocols.

The M&V Protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

Monitoring:

CDM stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity would reduce the carbon dioxide whereas an appropriate monitoring system would ensure this reduction is quantified and helps maintaining the required level.

Also a monitoring system brings about the flaws in the system if any are identified and opens up the opportunities for improvement.

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and Reporting

Frequency of Monitoring

Since the emission reduction units from the project activity would be determined by the steam consumption and generation along with the fossil fuel (coal) consumption in the project affected areas, it becomes important for the project activity to monitor the LP steam consumption in the evaporator plant, MP steam consumption in the ejector system of the evaporator plant and for soot-blowing in the chemical recovery boiler, the HP steam generation from

the chemical recovery boiler and the coal fired boilers along with the coal consumption in the latter, on a real time basis. An on-line metering system will be in place to monitor and record the relevant parameters.

Reliability

As the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result:

- All measuring instruments will be calibrated by third party/ government agency once in a year for ensuring reliability of the system.
- The Standard Testing Laboratory (under Central/State Government) will verify the reliability of the meter readings; thereby ensuring the monitored results are highly reliable.

Registration and Reporting:

Registration of data would be in the plant log-books. Monthly reports would be prepared stating the relevant parameters.

The parameters to be monitored for the project activity will be archived in the plant’s internal recording system (plant log books).

The project proponent will also maintain a GHG performance procedure on a regular basis. All the monitored parameters will be recorded for crediting period plus two years.

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