CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Haidergarh Bagasse Based Co-generation Power Project, Version 01, Dated 04/09/06;

A.2. Description of the project activity:

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The HCM project activity is a bagasse based cogeneration project at BCML plant Haidergarh Chini Mills (HCM). The purpose of the project activity is to utilize the waste bagasse of Balrampur Chini Mills Limited (BCML) sugar plant to generate steam and electricity for internal use and to export the surplus electricity to the Uttar Pradesh Power Corporation Limited (UPPCL) grid.

With an installed capacity of 20.25 MW, the HCM project activity uses a small portion of the steam-electricity generated in the new high efficiency bagasse-fired cogeneration system to run its new cane crushing facility and cogeneration plant. The surplus energy is exported to the grid. This measure thereby reduces grid-based GHG emissions that result from the country's overwhelming dependency on coal.

In addition, BCML installed an additional 3 MW steam turbine and generator set, which generates an average of 2 MW of power in the process of pressure reduction. With this, total power generation capacity increases to 23.25 MW with an average power generation of around 22.5 MW. The HCM project activity will substitute approximately 116.488 million kWh of electricity per annum, to the Uttar Pradesh Power Corporation Limited UPPCL grid.

The BCML's HCM project activity is unique in India due to its installation and use of high efficiency boiler for optimizing the amount of energy produced per unit of bagasse burned, thereby optimizing the potential surplus power generated from its available bagasse. Currently many sugar mills in India inefficiently burn their waste bagasse in cheaper, low pressure boilers to simply dispose of the residues, and generate steam and power for in-house consumption. With the goal of obtaining carbon revenues from the avoidance of grid-based GHG emissions, the company took the investment risks in 2003 in order to secure financing to invest in such high efficiency and higher capacity cogeneration system, thereby demonstrating the effectiveness of renewable, clean, and efficient power systems to the sugar manufacturing industry in India. The HCM project activity is highly replicable as the country's sugar mills annually produce vast quantities of bagasse wastes that could be far more efficiently burned to generate energy for on-site use and for off-site use through export of its surplus energy to the grid.

Project's contribution to GHG emission reductions

The greenhouse gas emission reductions from the HCM project activity result almost exclusively from the avoidance of fossil-fuel based GHG emissions at the grid by the substitution of clean, carbon neutral bagasse electricity. Bagasse, the cellulosic waste produced from sugar cane crushing, is a carbon neutral fuel as determined by the Inter-Governmental Panel on Climate Change (IPCC). It does not add any carbon dioxide (CO_2) to the atmosphere due to carbon recycling during the sustainable growth of sugar cane. Without the HCM project activity, the same amount of bagasse-generated electricity exported to the grid would need to be produced by the Northern Regional grid which relies primarily on GHG-emitting conventional fuels like coal and natural gas. After adjusting total electricity export from HCM by a small portion of the bagasse diverted from the paper industry[1], the estimated emission reductions associated with adopting a more efficient boiler -- and using biomass that would otherwise be burned in an uncontrolled manner without utilizing it for energy purpose amount to approximately 782,863 tonnes of CO_2 over a 10 year credit period.

Project's contribution to sustainable development

The HCM project activity engenders important local, national and global sustainable development benefits for India.

First, the HCM project activity substitutes, and hence decreases, the future need for primarily coal-based power generation by the grid, thereby reducing carbon dioxide (CO_2) and other (particulate, etc.) emissions from the Indian electricity sector. Since coal is supplied to meet country's major electricity demand, and is expected to increase over time according to the Northern Region's electricity board expansion plans,

[1] Guidance has been taken from F-CDM-AM-Rev_Resp_ver 01 - AM_REV_0013 regarding adjusting the net GHG emissions from the proposed activity by the subtraction of electricity generated by the amount of bagasse that otherwise would have been sold to the paper industry by the Babhabn Unit. Since out of the total bagasse utilized in the HCM project activity, part of it contributed by the Babhnan Unit alternatively would have been sold to the paper industry in the baseline scenario, the project participants propose not to claim for emission reductions associated to bagasse quantities that are diverted from feedstock (paper) uses to the HCM project activity

diversification and electricity generation through biomass residues by the sugarcane industry creates global as well as local air pollutant benefits. The HCM project activity positively contributes towards the reduction in demand for India's carbon intensive energy resources (like coal) as well as towards more efficient waste disposal and resource conservation.

Second, the HCM project activity has contributed to the local job and income creation in a very poor rural area where sugar cane growers (local farmers) face highly cyclical income flows. It has created steady, higher value jobs and skilled workers at the cogeneration facility. Finally, with the influx of carbon financing from the Project's net emission reductions, the BCML's HCM project activity has created a replicable model for the country's sugarcane industry to diversify its product offerings, increase its capabilities, and venture into the power sector.

In summary, the project's sustainable development benefits and issues include:

- Export of power, thereby eliminating the generation of same quantity of power using conventional fuel;
- Conserving and displacing coal, a non-renewable natural resource;
- Reducing GHG emissions through the avoidance of fossil-fuel grid electricity generation;
- Contributing to an increase in the local employment in the area of skilled jobs for the operation and maintenance of the cogeneration equipment;
- More efficient industry waste use by installing high efficiency boilers that maximize the power generated per unit of bagasse burned;
- Capacity building through training the mill owners, farmers and power plant operators in high efficiency cogeneration and export of electricity to the grid;
- Increasing the diversity and reliance of local energy resources;
- Improving the transmission grid reliability through distributed energy use; and,
- Providing a highly replicable, efficient model to other sugar mills in the state and country for use of bagasse as a renewable energy resource.

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)
Host Country - India [Ministry of Environment and Forests (MoEF)]	Balrampur Chini Mills Limited, India	No
Annex I Country Designated National Authority: Ministry of Housing, Spatial Planning and the Environment, State of the Netherlands	International Finance Corporation as facilitator for CER transaction for VROM	Yes

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.:

>> Uttar Pradesh

A.4.1.3. City/Town/Community etc:

>> Haidergarh

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

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The HCM sugar plant and the HCM project activity are located in the complex at Pokhra Village, Haidergarh Tehsil, Barabanki District in Uttar Pradesh. The plant is adjacent to the road connecting the Haidergarh Town and Pokhra Village.

The HCM project activity, consisting of the bolier, turbo-generator, auxiliary systems, switchyard *etc.,* is located adjacent to the evaporator house of the sugar plant. The interconnections for the HCM project activity and sugar plant have been done for the bagasse, steam, condensate, DM water and electrical systems. Other requirements of the HCM project activity, including water requirement, infrastructure facilities *etc*., are also available at site. The 132 kV transmission lines from the Cogeneration plant's switchyard is connected to the existing UPPCL sub-station at Jagadishpur, which is located nearby the project site.

A.4.2. Category(ies) of project activity:

>> The HCM project activity falls under the Category 1: Energy industries (renewable - / non-renewable sources) as per the scope of the project activities enlisted in the '**Sectoral scopes related approved methodologies and DOEs**'.

A.4.3. Technology to be employed by the project activity:

>> The HCM project activity is a grid-connected bagasse-based cogeneration power plant with a high-pressure steam generator and turbine configuration.

The plant is designed to operate a 120 Tons Per Hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 87 kg/cm^2 & 515 ^{0}C and a high efficiency Extraction cum Condensing (EC) type of turbo-generator set of 20.25 MW nominal capacity (operating with the steam inlet parameters of 84 kg/cm^2 and 510^{0}C) for higher power output.

The boiler is designed with a travelling grate with electric drive to burn bagasse. The inlet feed water is at 170^{0}C, with the feed water heated in high pressure feed water heaters. The deaerator outlet water temperature is 115^{0}C. The steam turbine and & generator (STG) set of 20.25 MW consumes a maximum of 102 TPH of steam during the cane crushing season and the boiler capacity is 120 TPH. Therefore HCM installed an additional 3 MW STG set, which will generate an average of 2 MW of power in the process of pressure reduction. With this, total power generation capacity of the HCM project activity increases to 23.25 MW with an average power generation from the project of around 22.5 MW.

The plant is designed with all other auxiliary plant systems including:

- Bagasse handling system with storage and processing arrangements
- High pressure feed water heaters
- Ash handling system

- Water treatment plant
- Compressed air system
- Air conditioning system
- Main steam, medium pressure and low pressure steam systems
- Fire protection system
- Water system which include raw water system, circulating water system, condensate system, de-mineralised water system and service with potable water system
- The electrical system for its successful operation.

The plant operates 300 days per annum, which includes around 140 days during the crushing season (November to March), with the balance of about 160 off-season days. After meeting the steam and power requirements of the co-gen auxiliaries and sugar plant, the remaining surplus power is exported to UPPCL. The power sets generate at 11 kV level. The internal consumption requirements for auxiliaries and equipment of the sugar plant and the co-gen plant are met by stepping down the voltage level to 415V. The exportable power needs to be stepped up to 132 kV and paralleled with the UPPCL grid at the nearby sub-station in Jagdishpur.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Table A.1 Estimated emission reductions for HCM Project over a 10-year crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Nov, 2003 – Oct, 2004	59806.7
2004 – 2005	76986.9
2005 – 2006	76986.9
2006 – 2007	76986.9
2007 – 2008	76986.9
2008 – 2009	76986.9
2009 – 2010	76986.9
2010 – 2011	76986.9
2011 – 2012	76986.9
2012 – 2013	76986.9
Total estimated reductions (tonnes of CO_2 e)	**752688.8**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e/yr)	**75268.8**

A.4.5. Public funding of the project activity:

>> No public funding from parties included in Annex I is available to 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 project activity:

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The project activity follows the following baseline methodology:

- Version 03 of ACM0006: "Consolidated baseline methodology for grid-connected electricity generation from biomass residues"

In line with the application of the methodology, the project also draws on elements of the following tools and methodologies:

- Version 02 of the "Tool for the demonstration and assessment of additionality"; and,
- Version 06 of ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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ACM0006 Version 03 is applicable to grid-connected and biomass residue fired electricity generation project activities, including cogeneration plants. This baseline methodology was selected and applied to the HCM project activity because the project activity adheres to the following project elements and applicability criteria as required by ACM0006 Version 03:

1. The installation of a new biomass power generation plant at a site where currently no power generation occurs (**greenfield power projects**);

   The HCM project activity is a green-field electricity generation project developed along with the HCM Sugar Plant.

2. The project activity may be based on the operation of a power generation unit located in an agro-industrial plant generating the biomass residues or as an independent plant supplied by biomass residues coming from the nearby area or a market;,

   For this specific methodology, biomass residues are defined as biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material.

No other biomass types than *biomass residues*, as defined above, are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired);

The HCM project activity is a grid-connected and bagasse-based renewable cogeneration project that exports surplus electricity to the UPPCL state grid, which is a part of the Northern Regional Grid.

Bagasse, the by-product of sugar industry, is the only type of biomass residue that is used as fuel in the HCM project activity. No other biomass types other than bagasse are used in the project plant. Bagasse is defined as the dry, fibrous biomass residue remaining after the extraction of juice from the crushed stalks of sugar cane in the sugar plant.

3. For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;

   Implementation of the HCM project activity has no direct/indirect effect on the bagasse production in the facility. The bagasse production is guided by the sugar production requirements.

4. The biomass used by the project facility should not be stored for more than one year;

   Maximum portion of the bagasse that is generated during the crushing season (which spans over 5 to 6 months) at the Haidergarh sugar plant is continuously being used in the HCM project activity. A portion of the bagasse is stored at Haidergarh premise for use in the non-crushing period but not stored beyond a year. With HCM project activity's bagasse requirement of 52.17 TPH during the crushing season and 35.2 TPH during non-crushing season, the bagasse is not stored at the project facility for more than ten months. Further, to ensure this requirement is met, the bagasse inventory is managed as per First In First Out (FIFO) method.

5. No significant energy quantities, except from transportation of the biomass, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils) are not eligible under this methodology.

   No significant energy quantities are needed to prepare the biomass residues for fuel combustion,

Hence, the HCM project activity thereby fulfills all applicability criteria required by the ACM0006 Version 03 baseline methodology.

B.3. Description of the sources and gases included in the project boundary

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Table B.1 Greenhouse gas emission sources and gases within the project boundary

	Emission Source	**Gas**	**Included/ Excluded**	**Justification/ Explanation**
Baseline	Grid Electricity Generation	CO_2	Included	Main Emission Source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat Generation	CO_2	Excluded	No emission reductions are claimed for heat generated by the project activity as under the baseline the same quantity of heat would be generated during the sugar crushing season.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of surplus biomass	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Emissions from uncontrolled burning or decay of biomass are not included to be on the conservative side.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	On site fossil fuel use due to project activity	CO_2	Excluded	No fossil fuel will be consumed at the project site.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Off-site transportation of biomass	CO_2	Excluded	The biomass from other units have been excluded as per the guidance of the Meth Panel
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Combustion of biomass for electricity and/or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in LULUCF sector.
		CH_4	Excluded	If the baseline accounts for emissions from these sources then they must be accounted for in project activity emissions, we have not accounted for these in the baseline and therefore exclude them from the analysis of project activity sources.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small.
	Biomass Storage	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The methodology requires BCML to first determine the realistic and credible baseline options regarding each of the following elements of the project:

1. **Power generation options at the cane mill and regional grid**: How power would be generated at the sugar cane mill and regional electric company in the absence of the CDM project activity;
2. **Heat production options at the cane mill**: In case of cogeneration projects, how the heat would be generated at the mill in the absence of the project activity; and,
3. **Biomass (bagasse residue) use and disposal options at the mill:** What would happen to the biomass at the mill in the absence of the project activity

Second, the methodology then requires BCML to determine the combinations of these baseline options (Baseline Alternatives) actually available to BCML in absence of the project activity, as per the guidance provided in ACM0006 Version 03. Table B.2 presents the potential power generation, heat production and biomass use/disposal baseline options along with an explanation of their credibility as baseline scenarios.

Table B.2 Potential power generation, heat production, and biomass use baseline options

Option	Description	Credibility	Conc.
Power Generation			
P1	The HCM project activity not undertaken as a CDM	The option is that a high efficiency bagasse based power system is installed at the HCM plant undertaken without the consideration of carbon financing, It is not credible given the barriers to project activity implementation outlined in Section B.5.	**No**
P2	A lower efficiency bagasse-fired power project (e.g. an efficiency as common practice in the Indian sugar sector)	Available power scenarios with BCML wherein the power generated by the HCM project activity would, in the absence of the project activity, be generated (a) in the reference plant and – since power generation is larger in the project plant than in reference plant - (b) partly in power plants in the grid.	**Yes**
P3	The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels	A credible baseline possibility only if part of power capacity expansion projects at the cane mill, which are operated next to existing power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant. As the project activity is a part of the new Greenfield	**No**

		Sugar Project undertaken by BCML at Haidergarh (and there was no existing power generation capacity available on-site or nearby the project site), P3 is not a credible baseline option in absence of the project activity.	
P4	The generation of power in existing and/or new grid-connected power plants	Same credibility explanation as P4.	**Yes**
P5	The continuation of power generation in an existing power plant, fired with the bagasse, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant	Same credibility explanation at P3.	**No**
P6	The continuation of power generation in an existing power plant, fired with the bagasse as in the project activity and, at the end of the lifetime of the existing plant, replacement of that plant by a similar new plant	Same credibility explanation at P3.	**No**

Table B.2 cont'd

Option	Description	Credibility	Baseline
Heat Production			
H1	The HCM project activity is not undertaken as a CDM project activity	The project activity does not generate additional heat with reference to option H2, so option H1 has not been considered separately.	**No**
H2	The HCM project activity (installation of a cogeneration power plant), fired with the same type of biomass but with a different efficiency of heat generation (e.g. and efficiency that is common practice in the relevant industry sector)	Amongst H2, H4 and H6, H2 is the most realistic/conservative option wherein bagasse is fired in the cogeneration plant (reference plant) to meet the sugar plant's process steam requirements. Option H2 has been adopted by all Indian sugar plants. For additional bagasse used for power generation, the heat option is not applicable as the entire heat requirement of the sugar plant will be met from the H2 and the turbine will operate in the condensing mode.	**Yes**
H3	The generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels	A credible option only to power capacity expansion projects, which are operated next to existing power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant. The project activity is a part of the Greenfield Sugar Project undertaken by BCML at Haidergarh with no existing power generation capacity available on-site or nearby the project site, so it is not a credible option to the project activity.	**No**
H4	The generation of heat in boilers using the same type of biomass residues	See credibility explanation for H2.	**No**
H5	The continuation of heat generation in an existing power plant, fired with the same type of biomass as in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant	Same credibility explanation as H3.	**No**

Table B.2 cont'd

Option	Description	Credibility	Baseline
Heat Production			
H6	The generation of heat in boilers using fossil fuels	See credibility explanation for H2.	**No**
H7	The use of heat from external sources, such as district heat	District heat is not a credible option available for BCML or other Indian sugar plants.	**No**
H8	Other heat generation technologies (e.g. heat pumps or solar energy)	Heat pumps are not credible options available for BCML or other Indian sugar plants	**No**
Biomass Use and Disposal			
B1	The biomass is dumped or left to decay or burned in an uncontrolled manner without utilising it for energy purposes	The bagasse used for electricity generation in the project includes bagasse generated at Haidergarh unit. Additional bagasse generated at the Haidergarh Unit with no energy use would be burned in an uncontrolled manner. B1 is most credible option.	**Yes**
B2	The biomass is used for heat and/or electricity generation at the project site	Bagasse utilized for the power and heat options P2 and H2, respectively, would be categorized under Option B2. This is a credible baseline option.	**Yes**
B3	The biomass is used for power generation, including cogeneration, in other existing or new grid connected power plants	B3 is a credible option primarily to power capacity expansion projects, which are operated next to existing heat/power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant. As the project activity is a part of the Greenfield Sugar Project undertaken by BCML at Haidergarh with no existing heat/power generation capacity available on-site or nearby the project site, B3 is not a credible option to the project activity.	**No**
B4	The biomass is used for heat generation in other existing or new boilers at other sites	See credibility explanation B3.	**No**
B5	The biomass is used for other energy purposes, such as the generation of biofuels	The bagasse generated at the Greenfield Haidergarh Sugar Plant had no use (i.e. B3, B5 and B6 not applicable)	**No**
B6	The biomass is used for non-energy purposes, e.g. as fertilizer or as feedstock in processes	Small quantum of bagasse used for electricity generation in the project activity includes bagasse generated at other BCML units. Bagasse generated at other BCML units was utilized for non-energy uses however with no guidance available in the ACM0006 Version 03 methodology it will be excluded as per the guidance provided by	**No**

		Meth Panel (F-CDM-AM-Rev_Resp_ver 01 – AM_REV_0013).	

After conducting the above separate assessments, BCML next determined the most credible alternative baseline scenarios, which are a combination of the most credible power generation, heat production and biomass use options. These baseline alternatives apply to the HCM project activity and to other sugar-manufacturing units in India[2]. Step 3 of the latest approved version of the "Tool for the determination and assessment of additionality" has been used to assess and identify the baseline scenario amongst the potential alternatives.

The following section describes the various baseline alternatives evaluated by BCML and Table B.3 presents these scenarios:

Alternative 1- Cogeneration unit to meet the plant's power and steam requirements

In Alternative 1 BCML may implement a bagasse based Cogeneration Unit designed to meet the sugar plant's in-house steam and power requirements. The alternative does not entail any surplus power generation and export to an electricity grid. During non-crushing season, there will be no process steam requirement and very low power requirement, therefore the cogeneration unit would be non-operational and the power requirement of the HCM sugar plant would be catered to by the UPPCL grid.

In Alternative 1 the configuration of the Cogeneration Unit would be designed as follows:

Table B.3 Baseline Alternative 1 considered for the HCM Project Activity

General HCM Sugar Mill Characteristics and Energy Needs:		
Cane Need:	4500 Tonnes Cane per Day Capacity	
Mill Power requirement:	4.3 MW	
Mill Low Pressure Steam requirement:	87 TPH	
Mill Medium Pressure Steam requirement:	3 TPH	
Crushing Season :	140 days	
Non-Crushing Season :	160 days	
Alternative 1- Cogeneration unit to meet the plant's power and steam requirements		
Project Elements	**Baseline Option(s)**	**Greenfield Project Description and Characteristics**
Power	P2 and P4	Reference Plant: The Cogeneration plant is designed to operate a 85 Tons Per Hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 45 kg/cm^2 & 415 ^0C and an Extraction cum Condensing (EC) type of turbo-generator set of 6 MW nominal capacity for power output. The reference plant will meet 4.31MW power requirement of the HCM Sugar plant and 1.31MW power requirement of the cogeneration plant during the crushing season. The 0.125 MW power requirement of the HCM Sugar Plant in the Non-crushing season is catered to by the grid. The Cogeneration plant does not export electricity to the UPPCL grid.

[2] A coal-fired power station or hydropower are not available alternatives for BCML a sugar factory owner investing in a co-generation and have therefore not be considered. Alternatives are, therefore, related to technology and circumstances as well as the investor.

Heat (if relevant)	H2	The Cogeneration plant is designed to meet the heat requirements of the Haidergarh Sugar Plant. The reference plant will provide 87 TPH L.P. steam and 3 TPH M.P.
Alternative 1- Cogeneration unit to meet the plant's power and steam requirements		
Project Elements	**Baseline Option(s)**	**Greenfield Project Description and Characteristics**
Biomass	B2 and B1	The 189,000 Tons per annum of Bagasse is generated at Haidergarh. **B2:** 127,102 Tons of bagasse generated at Haidergarh is utilized in the Reference Plant - Cogeneration plant. **B1:** The balance 61,897 Tons per annum of bagasse of Haidergarh is burned in an uncontrolled manner without utilizing it for energy purposes

This Alternative 1 is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline. This Alternative does not face any prohibitive barriers and is a predominant scenario in the Indian sugar industry. In India, all the sugar mills have their own bagasse based cogeneration units, operating with low-pressure boiler configuration of below 45 kg/cm^2 (Lower efficiency systems: Maximum are in the range of 21 kg/cm^2 to 45 kg/cm^2), with the objective to cater to the in house steam and power requirements of the sugar mills. The efficiency design of the cogeneration plant - reference plant of Alternative 1 is determined based on the steam and power requirements of the sugar plant.

Alternative -2: Cogeneration unit to meet the plant's energy requirements with surplus power generation for export to grid [Project Activity] without CDM benefits

In Alternative 2 BCML may implement a bagasse based Cogeneration Unit designed to meet the sugar plant's in-house steam and power requirements and generate surplus electricity for export to grid. By installing a higher capacity cum high efficiency power generation system with high-pressure boiler configuration the sugar mills can produce surplus power that can be exported to the grid. During non-crushing season too, the cogeneration would be operational and the surplus power generation may be exported to UPPCL grid. In Alternative 2 the configuration of the Cogeneration Unit would be designed as follows:

Table B.4 Baseline Alternative 2 considered for the HCM Project Activity

General HCM Sugar Mill Characteristics and Energy Needs: (Same as in Table B.3)		
Alternative 2- Cogeneration unit to meet the plant's power and steam requirements		
Project Elements	**Baseline Option(s)**	**Greenfield Project Description and Characteristics**
Power	Project Scenario	HCM project activity: The Cogeneration plant is designed to operate a 120 Tons Per Hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 87 kg/cm^2 & 515 ^{0}C and a Extraction cum Condensing (EC) type of turbo-generator set of 20.25 MW nominal capacity for power output. The STG set of 20.25 MW consumes maximum of 102 TPH of steam during crushing season. HCM proposes an additional 3 MW steam turbine & generator set which will generate an average of 2 MW of power with the additional steam. With this, total power generation capacity increases to 23.25 MW with an average power generation of around 22.5 MW. With The reference plant will meet 4.31 MW power requirement of the HCM Sugar plant and 1.98 MW power requirement of the cogeneration plant. The Cogeneration plant will export 16.2 MW of surplus power to the UPPCL grid during the crushing season and 17.875 MW during non-crushing season.
Heat (if relevant)	H2: Project Scenario	The Cogeneration plant is designed to meet the heat requirements of the Haidergarh Sugar Plant. The reference plant will provide 87 TPH L.P. steam and 3 TPH M.P.
Biomass	Project Scenario	The 189,000 Tons of Bagasse generated at Haidergarh per annum and 109,689 Tons of bagasse of Other Units (Babhnan) per annum is utilized in the Cogeneration plant but will not be considered for emission reductions claimed by BCML.

This Alternative 2 is in compliance with all applicable legal and regulatory requirements and could be a part of the baseline. However there is no legal requirement in terms of producing energy from its bagasse residues binding on BCML to take up the Alternative 2. However, this alternative has associated barriers to its implementation (please refer to Step 3: Barrier Analysis in Section B.5 below). Therefore the Alternative 2 may be excluded from further consideration.

Considering all the points mentioned above, **"Alternative 1- Cogeneration unit to meet the plant's power and steam requirements"** was found to be the only most likely alternative baseline option available to BCML in absence of the project activity. Hence, as per the methodology, this alternative option is the baseline scenario. This is further substantiated by the following fact that:

- This scenario was the status quo for all other existing facilities of BCML. Until March 2003, BCML was a sugar-manufacturing company with all their plants at Balrampur, Babhnan operating at low pressure, low efficiency boiler configurations, and with no export of electricity.[3] The electricity produced by BCML using bagasse as a fuel was only for captive consumption to meet the steam and power requirements. BCML registered as a sugar mill in the year 1956 and has successfully completed forty-five seasons of sugar manufacturing. With a long history of sugar production and no power export it is very likely that in absence of the CDM project activity, BCML would have continued with its business as usual or historic way of sugar production and adopted a similar project activity at their Haidergarh Chini Mills (Alternative 1). In fact BCML's sugar units, old unit at Balrampur (at Balrampur, BCML has one new and one old sugar plant) and Babhnan are operating at low pressure, low efficiency boiler configuration, which endorse the fact that in absence of HCM project activity BCML would have continued with Alternative 1.

The GHG performance of the project activity and its associated emission reductions were evaluated with respect to the selected baseline scenario. Please refer to Section B.6 for further details.

[3] BCML developed their first project activity– "Balrampur Baggase Cogeneration Project", a high pressure cogeneration unit using bagasse as fuel in March, 2003 under CDM.

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 CDM project activity (assessment and demonstration of additionality): >>

The HCM project activity is a bagasse-based cogeneration system connected to an electricity grid. It is a renewable energy-based power project (shown later to have a net CO_2 emission factor of 0 tonnes CO_2/MU) that exports power to the Uttar Pradesh grid. The surplus power generated from HCM project activity that is exported to the grid and displaces electricity otherwise generated by grid-connected power plants in the Northern Regional Grid (shown later to have a CO_2 emission factor of 916.81 ton CO_2/MU) in absence of the HCM project activity.

The project proponent is required under CDM rules to establish that the estimated GHG emission reductions due to the project activity are additional to those that would have occurred in absence of the HCM project activity, based on the CDM's Version 02 of the 'Tool for the demonstration and assessment of additionality'. The demonstration of the HCM project activity to meet CDM's additionality criteria is presented below, following the Steps outlined in the Tool. Information/data related to industry practices, regulatory issues, and other project related documents have been used by BCML to establish the additionality of the HCM project activity.

Step 0. Preliminary Screening based on the starting date of the project activity

BCML wishes to have the crediting period starting prior to the registration of their HCM project activity. BCML is therefore required to:

(a) Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity, bearing in mind that only CDM project activities' which have submitted a baseline methodology before 31 December 2005 may claim for a crediting period starting before the date of registration; and

(b) Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

The HCM project activity proposal was submitted for BCML management approval on 12th September 2002. The Annex-I of the 2002 management proposal elaborated for management's consideration all risks/uncertainties that could lead to project failure (closure/temporary discontinuity) and their impacts on HCM's sugar plant operations. A brief of the project related risks (i.e., barriers to project implementation) has been provided in Step 3 below. Each of the barriers, especially the investment, institutional, and technological barriers could result in project failure resulting in huge financial losses for the company. The

Annex-II of the 2002 management proposal provided preliminary estimates of the financial incentives the project activity would receive over a 10-year credit period from sale of Certified Emission Reductions (CERs) under successful approval by the Clean Development Mechanism at the historic carbon market prices. The BCML project execution team along with the technology design provider computed the proposed CDM revenue for BCML management's consideration at this time.

The various aspects of the proposal and annexes were discussed in the Board of Director's Meeting held on 20th October 2002. BCML's management made the decision to take the project investment risks and securing the finance partially from bank funding and partially through internal accruals so as to invest in the HCM project activity (as contrasted with alternative higher return investment options). Consideration of the incentive from carbon funding if provided the CDM approval has helped BCML to decide and proceed with the project activity. BCML chose one of the renowned consultants in India to guide them through the project registration process and facilitate transaction of CERs.

Other relevant facts demonstrating BCML's commitment since 2002 to the project include:

- The construction of the HCM project activity started in November 2002. The project start date (the project activity received Board approval) and the construction date of the HCM project activity therefore falls between 1 January 2000 and the date of the registration of a first CDM project activity {18th November 2004[4]}. BCML would provide evidences to establish the same.
- The operation start-up date of the HCM project activity in November, 2003.
- BCML proposed a baseline methodology before December 31, 2005.

There is sufficient evidence available in the form of documentation, hence, demonstrating that the CDM incentive played a major role in the BCML Management's approval of the HCM project activity. The following are documents readily available that can be shown as evidence to support that the financial incentive from obtaining CDM-based carbon funding was seriously considered by BCML in the decision to proceed with the project activity:

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

Sub-step 1b. Enforcement of applicable laws and regulations

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[4] Reference: http://cdm.unfccc.int/Projects/registered.html

In sub-step 1a and 1b, BCML is required to identify realistic and credible alternative(s) that were available to BCML or similar project developers that provide output or services comparable with the HCM project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

BCML identified above in Section B.4 the different potential power generation, heat production and biomass residue use alternative(s) available to the HCM project activity and all other sugar-manufacturing units in India.[5]

- **Alternative 1- Cogeneration unit to meet the plant's power and steam requirements**
- **Alternative -2: Cogeneration unit to meet the plant's energy requirements with surplus power generation for export to grid [Project Activity] without CDM benefits**

Please refer to section B.4 for details on the alternatives and selection of the baseline scenario.

Step 2. Investment analysis OR

Step 3. Barrier analysis.

BCML proceeds to establish project additionality by conducting the ***Step 3: Barrier Analysis***.

BCML is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and

(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps:

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

The potential for power generation in UP using bagasse from the regional sugar industry is estimated at 1,350 MW per year, which is roughly 15% of the current installed capacity (9,000 MW) of the Northern

[5] A coal-fired power station or hydropower are not available alternatives for BCML a sugar factory owner investing in a co-generation and have therefore not be considered. Alternatives are, therefore, related to technology and circumstances as well as the investor.

Regional grid.[6] There are several major barriers due to which the above industry potential is not being harnessed. The HCM project activity also had to overcome critical investment, institutional and technological barriers for successful implementation to bring about the projected greenhouse gas reductions, which are also outlined below.

(a) Investment barriers

High upfront capital costs, the lack of easy and long-term financing, negative initial project cash flows issues and negotiating bankable power purchase agreements (PPA) are just many of the known investment barriers to the implementation of high pressure bagasse-based power projects for captive and grid-export systems by the Indian sugar industry. The project costs (mostly capital) of a conventional low-pressure cogeneration project fired with bagasse wastes (Alternative 1) are drastically lower than the relative project costs of a high-pressure configuration (Alternative 2). Unless a bankable PPA can be transacted between the mill and local power user(s), it simply is not financially viable for mills to install high pressure cogeneration systems that maximize power output per ton of bagasse burned to generate excess (surplus) power for sale to the retail electricity market.

Most sugarcane growers also do not have the stable cash flows to obtain private sector financing for investing in high efficiency cogeneration technology due to the cyclical nature of the primary product (sugar), hence their seasonal income flows. The price of sugar cane in India is controlled and governed / pre-decided by government. To protect sugar cane farmers' interests a minimum sugar cane price based on the quality of sugar cane is pre-decided. Also, until 2002 the government of India set quotas and the price of sale of sugar (as per the quota).

Due to such financial restrictions, the accumulation of sufficient funds to finance a high investment and capital-intensive energy project (going beyond meeting the sugar mill's captive steam and power needs), such as the high efficiency HCM project activity, is a difficult proposition for many mill owners. Further most companies, including BCML, have no background in exporting power to the grid or other retail electricity users, so seeking such financing from a private bank proves another key barrier. Banks also demand from any investor a set of 'bankable' contracts (i.e., resource supply, power purchase agreement, private power electricity price schedules, etc,) that provide enforceable product price and purchase guarantees to determine the minimum cash flow scenario(s). Thus, BCML by investing in the higher cost, high efficiency renewable energy project in 2002 needed to invest part of its own equity and make collateral

[6] Reference: All India Bagasse Co-generation Study of IREDA, taken from CII investor guidebook for bagasse

promises to obtain bank financing to proceed forward, and thereby was taking on a broad set of investment risks that many other sugar mill owners and commercial financiers in India are not willing to bear.

Despite these investment barriers, BCML's management took this decision of pursuing the HCM project activity in the midst of additional carbon market risks including: the GHG market uncertainties involved with returns from the HCM project; the transaction under the CDM and rate of CER; and other institutional, technological and operational risks associated to project implementation. Besides the direct financing risk, BCML is also shouldering the additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements. In absence of an Approved Methodology for 'Bagasse based grid connected project' BCML submitted a proposed methodology for consideration in September 2003. In September 2004 approved consolidated baseline methodology ACM 0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" was made available by Executive Board of UNFCCC and was based on elements from the earlier submitted NM0030-rev: Haidergarh Bagasse Based Co-generation Power Project in India. Hence, BCML has shouldered a significant investment risk and taken a pro-active approach by showing confidence in the Kyoto Protocol/CDM system.

(b) Technological Barriers

The typical technological alternative to the HCM project activity is to continue to use low or medium pressure co-generation configuration systems. The project activity, however, has adopted a high pressure co-generation technology, which is new in UP and in India as well. High pressure generation systems have a very low market share and lower penetration rate than its other less efficient alternatives in the Indian sugar industry. The penetration of new high efficiency cogeneration technology requires greater economies of scale, trouble-free plant operation, availability of spares, availability of skilled manpower to operate the plant continuously *etc*. In 2002, BCML was the first company in UP to take the risk by looking for carbon financing to overcome the technology barrier and investing in the 87 kg/cm^2 pressure and Steam Turbine Generator (STG) set of double extraction cum condensing technology. The technological barriers become even more significant considering the untapped renewable energy potential in UP from the sugar industry using bagasse as a fuel. As mentioned above the potential for power generation in UP using bagasse is estimated at 1,350 MW per year, which is roughly 15% of the current installed capacity (9,000 MW) of the

based cogeneration

regional grid. Success of the CDM project will provide a trigger for replication in other sugar mills thus further reducing the GHG emission to the atmosphere.

(c) Other Barriers

- ***Managerial resources barriers:*** BCML has 45 years experience with sugar cane and sugar production. The region where the plant is implemented is dominated by agriculture and there are no large industries nearby. Because of this local job skill pool, the trained manpower capable of handling a high-pressure configuration co-generation system was not readily available to BCML. It had to overcome this managerial resource barrier through investing in management and operational training in order to implement the HCM project activity.

- ***Organisational barriers:*** The sugar-manufacturing sector belongs to the agricultural sector with only a limited knowledge of and exposure to the complications associated with commercial production and sale of electricity. The high efficiency bagasse-based power projects exporting electricity to retail buyer is a steep diversification from the core (rural) industry economy into the power sector market. In the latter, the project proponents have to meet the challenges of changing power policies, delivery/non-delivery of the power product (synchronization, take or pay contracts and penalties), and other techno-commercial problems associated with dealing with state electricity boards (*etc)*. BCML has been involved in only the business of sugar production and rural economics. The company had to diversify and transform itself to overcome many organizational barriers to develop a new set of management and operational expertise to compete in electricity generation, distribution, regulation and pricing. .

- ***Institutional Barriers:*** HCM-project activity had to sign a Power Purchase Agreement (PPA) with the Uttar Pradesh State Electricity Board (UPSEB) to facilitate the sale of its surplus bagasse-based electricity to UPPCL. To obtain their revenues, the project depends on payment from UPSEB against the sale of electricity to the grid, proven by standard metering. It was known during the early project years that the liquidity and financial conditions of state electricity boards in India were not very healthy[7]. BCML's management realized the institutional risks that there could be problems with the HCM project's cash flows due to uneven payments from UPSEB. BCML, however, undertook this risk and faced this barrier on which they have limited or no control. This

[7] Reference: Official website of Uttar Pradesh Government, India. www.upindia.org

risky payment situation makes CDM-based carbon funds even more critical for the financial viability of the HCM project activity.

It is estimated that of the total project proponents who get approval from central/state electricity authority to establish bagasse/biomass based power project in India only a few are successful in commissioning of the plant due to some of the above mentioned variety of barriers. The data on the Common Practice Analysis (Step 4) of the bagasse-based cogeneration suggests that these barriers discussed above are quite strong enough to have seriously hindered the growth and diversification of the Indian sugar industry into the power sector.

Sub-step (3b). Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (except the proposed project activity):

It has been observed in Sub-step 3a that the HCM- project activity had its associated barriers to successful implementation, which have been overcome by BCML taking on significant market and non-market risks in order to implement the project to reduce grid-based greenhouse gas reductions. The Alternative 1, the most realistic alternative available to BCML for their Haidergarh Chini Mills in absence of HCM project activity was evaluated. Alternative 1 proposes to focus strictly on the plant's core business of production of sugar. Since the barriers mentioned above are directly related to venturing into a new business of export of power to grid (electricity sale), there are no impediments for sugar-manufacturing plants (and BCML) to implement Alternative 1.

Step 4-a. Common Practice Analysis

From the Step 1 Identification of Alternatives and Step 3 Barrier Analysis, we may conclude that Alternative 1 (no surplus power generation) does not have impediments that prevent their implementation. However the Alternative 2 (high efficiency/surplus power generation) faces barriers, which would prevent BCML from implementing the project activity as elaborated in the step 3 'Barrier Analysis'.

The common practice scenario tabulated below substantiates that the Alternative 2 - project activity without CDM benefits -- is not a widespread proposition for the sugar-manufacturing units in similar socio-economic environment of Uttar Pradesh State. The Alternative –1 (Cogeneration unit to meet the plant's energy requirements with no surplus power generation) is the most common practice adopted by the sugar-manufacturing units. The Indian sugar-manufacturing units have been routinely utilizing their bagasse in an inefficient manner by use of low-pressure boiler to generate steam and electricity only for in-house consumption.

Following data substantiates that the project is not a common practice in the proposed area of implementation.

Table B.5 Data on co-generation practices adopted by Uttar Pradesh sugar mills

Alternative Baseline Scenarios	Mills (Number)
Alternative 1- Cogeneration unit to meet the plant's power and steam requirements	94
Alternative -2: Cogeneration unit to meet the plant's energy requirements with surplus power generation with CDM benefits taken into consideration	3[8]

In India, only five[9] sugar mills from a total of more than 450 sugar mills, are operating with grid connected cogeneration unit of high pressure configuration of 87 kg/cm2 (equivalent configuration as of HCM project activity). Out of these five cogen units, three are in Uttar Pradesh state. BCML is the first project proponent in Uttar Pradesh that has pursued two CDM projects - BCML project activity at Balrampur and HCM project activity at Haidergarh to bring about additional GHG reductions and avail the revenues from sale of carbon emission reductions. In the absence of these CDM project activities there would be no bagasse-based cogeneration unit, which would meet the plant's energy requirements and generate surplus power to export to the grid. This shows that there is quite poor penetration of this surplus power and high-efficiency technology in Uttar Pradesh. In absence of the two project activities developed under CDM, the project activity simply does not occur in similar industries and is therefore not a common practice.

Step 5. Impact of CDM registration

The potential benefits and incentives realised due to approval and registration of the project activity as a CDM activity will certainly improve the sustainability of the project activity and thus its consideration before implementation and operation in 2003 helped to overcome the identified barriers (Step 3), which enabled BCML management to go forward with the project activity.

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[8] Apart from BCML Haidergarh, the other units are (1) The first unit of BCML at Balrampur, UP and (2) Triveni Engineering & Industries Limited, at Deoband. Both these units are depending on obtaining CDM approval and, hence, the potential revenues from the sale of CERs.

[9] In India, apart from Balrampur Unit, other units, which have set 'Baggase-based cogeneration connected to electricity grid ' under the CDM are of Kakatia Sugar, AP and Bannari Amman, Sathyamangalam, TN.

As mentioned above in Step 0, before implementation of the HCM project activity, BCML considered all the barriers discussed above. Each of them -- especially the investment, institutional and the technological barriers -- could have resulted in project failure and huge financial losses. BCML's management took the investment risks and secured financing (coming partially from bank funding and internal BCML accruals) so as to invest in the CDM process after adjusting for the potential carbon financing.

In summary, the corporate decision to invest:

- in overcoming the barriers facing project implementation and operation;
- in the CDM project activity through equity' and,
- in additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements

was guided by the anthropogenic greenhouse gas emission reductions the project activity would result in and its associated carbon financing the project activity would receive through sale of CERs under the Clean Development Mechanism .

It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial assistance, policy initiatives, or other incentives exist locally to foster its development in India. Without the proposed carbon financing for the project, BCML would not have taken the risks of implementing the HCM project activity. Further, CDM funds will provide additional coverage of the institutional risks and technical problems related to operation of the HCM project activity. The lack of funding may result in untimely shut downs of plant and its associated loss of production. In such an event the BAU baseline option is continued with release of carbon dioxide emissions.

As per the above-mentioned steps, the HCM project activity is deemed additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the registered CDM project activity.

Further, with CDM project activity registration, more sugar manufacturing industries in India could take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reductions.

B.6 Emission reductions:

B.6.1. Explanation of methodological choices:

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Steps adopted to calculate the baseline emissions, project emissions, emissions associated to leakage and emission reductions: The following section presents the overview of the steps BCML followed according to ACM0006 Version 03 to calculate the GHG emission reductions from the HCM project activity. In addition, this section includes the key information and data used to apply the GHG emissions estimation methodology to the HCM project activity. The supporting data values used to determine the 'CO_2 emission factors' and other information are provided in Annex 3 to the PDD.

Baseline

The baseline scenario for the HCM project activity was determined above to be Alternative 1: "Cogeneration unit to meet only the sugar plant's power and steam requirements" as it was found to be the most appropriate and applicable baseline scenario.

In this scenario, the sugar manufacturing company uses its bagasse as fuel in low pressure boiler for meeting only the on-site steam and power generation for in-house utilization, and there is no surplus power generated by the mill to be sold to the grid. Hence, in the baseline the grid must produce -- using its fossil dominated fuel mix -- the amount of surplus power displaced by the HCM project.

The equations, supporting data, and results for determining the GHG emissions and emission reductions by the project activity are provided below, following the guidance of ACM0006 Version 03 (dated 19 May 2006).

Estimation of emission reductions resulting from the project activity

As per the methodology, the HCM project activity mainly reduces CO_2 emissions through substitution of power generation with fossil fuels by energy generation by bagasse. The annual emission reduction (ER_y) avoided by the project activity during a given year y is the difference between the emission reductions through substitution of electricity generation with fossil fuels ($ER_{electricity,y}$), the emission reductions through substitution of heat generation with fossil fuels ($ER_{heat,y}$), project emissions (PE_y), emissions due to leakage (L_y) and, where this emission source is included in the project boundary and relevant, baseline emissions due to the natural decay or burning of anthropogenic sources of biomass ($BE_{biomass,y}$), as follows:

$$ER_y = ER_{heat,\,y} + ER_{electricity,\,y} + BE_{biomass,\,y} - PE_y - L_y$$

where:

ER_y	are the emissions reductions of the project activity during the year y in tons of CO_2,
$ER_{electricity,y}$	are the emission reductions due to displacement of electricity during the year y in tons of CO_2,
$ER_{heat,y}$	are the emission reductions due to displacement of heat during the year y in tons of CO_2,
$BE_{biomass,y}$	are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,
PE_y	are the project emissions during the year y in tons of CO_2, and
L_y	are the leakage emissions during the year y in tons of CO_2.

The total net emission reductions due to the HCM project activity are quantified per the guidelines given in the methodology after consideration of:

- Emission reductions due to displacement of electricity;
- Emission reductions or increases due to displacement of heat if any;
- Project emissions from on-site consumption of fossil fuels if any;
- Project emissions from combustion of fossil fuels for transportation of biomass to the project plant if any; and,
- Emissions associated to leakage.

The total net emission reductions due to the HCM project activity does not consider:

- The baseline emissions due to natural decay or burning of anthropogenic sources; and,
- The project (methane) emissions from combustion of biomass since this emission source is excluded from the project boundary.

Project Emissions

As per the methodology, project emissions include CO_2 emissions from transportation of biomass to the project site (PET_y) and CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$) :

$$PE_y = PET_y + PEFF_{CO2,y}$$

where:

PET_y	are the CO_2 emissions during the year *y* due to transport of the biomass to the project plant in tons of CO_2,
$PEFF_{CO2,y}$	are the CO_2 emissions during the year *y* due to fossil fuels co-fired by the generation facility in tons of CO_2,

The emission source CH_4 emissions from combustion of biomass ($PE_{Biomass,CH4,y}$) is excluded from the project boundary and is therefore not included in the equation for project emissions.

a) Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass to the project plant (PET_y)

Emissions may be calculated on the basis of distance and the number of trips (or the average truck load), using Option 1 of ACM0006 Version 03:

$$PET_y = N_y \cdot AVD_y \cdot EF_{km,CO2} \quad (3)$$

or

$$PET_y = \frac{\sum_i BF_{i,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO2} \quad (4)$$

where:

N_y	is the number of truck trips during the period y.
AVD_y	is the average return trip distance between the biomass fuel supply sites and the site of the project plant in kilometers (km),
$EF_{km,CO2}$	is the average CO_2 emission factor for the trucks measured in t CO_2/km, and
$BF_{i,y}$	is the quantity of biomass type i used as fuel in the project plant during the year y in a volume or mass unit,
TL_y	is the average truck load of the trucks used measured in tons or volume of biomass

The bagasse used for the HCM project activity is supplied by the Haidergarh and other BCML Units. The emission reductions associated to the biomass quantities from BCML Units other than Haidergarh have not been claimed for as per the guidance provided by Meth Panel in F-CDM-AM-Rev_Resp_ver 01 - AM_REV_0013 and is excluded from the project boundary. There is no fossil fuel combustion for transportation of bagasse generated in the Haidergarh Chini Mills, so PET_y is zero.

b) Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$)

The proper and efficient operation of the biomass power plant may require using some fossil fuels, e.g. for start-ups or during winter operation (when biomass humidity is too high). Project participants may also co-fire fossil fuels to a limited extent in order to enhance the economic performance of the plant.

CO_2 emissions from combustion of respective fuels are calculated as follows:

$PEFF_y = \sum FF_{project\ plant,i,y} \cdot COEF_{CO_2,i}$

where:

$FF_{project\ plant,i,y}$ is the quantity of fossil fuel type i combusted in the biomass power plant during the year y, and
$COEF_{CO_2,i}$ is the CO_2 emission factor of the fuel type i.

There is no fossil fuel combustion associated with the HCM project activity, hence there are no project emissions associated to fossil fuel combustion due to the HCM project activity implementation ($PEFF_y$ = 0). Therefore project emissions due to fossil fuel combustion have not been considered.

However 'Quantity of fossil fuel used at the project site due to HCM project activity' is a part of the Monitoring Plan and the CO_2 emissions from the combustion of any fossil fuels would be appropriately accounted for if any.

Leakage

The main potential source of leakage for this type of project activity is an increase in emissions from fossil fuel combustion due to the diversion of the biomass (bagasse) feedstock from other uses to the project plant.

In order to assess if the HCM project activity has resulted in leakage, BCML quantified the total bagasse generated at Haidergarh and determined the alternatives available to handle the same (Table B.6).

Table B.6 Bagasse Availability for HCM project activity operations

Bagasse Generation (Tons/yr) at HCM	**189,000**
Baseline Scenario	
B2: Bagasse Consumption in reference plant	127102.3388
B1:Bagasse combusted through uncontrolled burning	61897.6612
Total Bagasse Generated at HCM will be consumed in Project Scenario	189,000

d) Handling of Bagasse generated in Haidergarh Chini Mills Sugar Plant

Since the HCM sugar plant is a greenfield power project, the bagasse generated at the sugar plant was not available for use to other users. Therefore there is no diversion of biomass resulting to an increase in emissions from fossil fuel combustion at other sources with respect to the quantity of bagasse generated in HCM Sugar plant.

Further, out of 1,89,000 tonnes of bagasse generated in the sugar plant, 1,27,102 tonnes would be utilized by the reference plant and the surplus 61,897 tonnes would be combusted in an uncontrolled manner.

Therefore the 61,897 tonnes of biomass combusted falls under the B1 Scenario: "The biomass is dumped or left to decay or **burned in an uncontrolled manner without utilizing it for energy purposes**"

Due to surplus availability of bagasse, it was found that there were no energy or non-energy sources which would utilize the surplus bagasse and the surplus bagasse would have to be combusted in an uncontrolled manner in absence of the HCM project activity. Where the most likely baseline scenario (or part of the scenario) is that the biomass is dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes, the project participants shall demonstrate that the biomass used in the plant did not increase fossil fuel consumption elsewhere. This shall be done by demonstrating that there is abundant surplus of the biomass in the region of the project activity which is not utilized. Abundant biomass availability would be demonstrated as per L2 of the baseline methodology through a third party study conducted on the availability of bagasse within 200 km of HCM sugar plant. The study report survey and findings conclude that the quantity of bagasse available is more than 25% greater than the total quantity utilized in the region around the HCM Sugar Plant.

The study on the bagasse availability is also a part of the monitoring plan, and under situations wherein abundant biomass availability is not demonstrated as per L2 of the baseline methodology leakage effects for the year y shall be accounted for in the total ERs reported.

Further, the following table presents the biomass availability in Uttar Pradesh. The potential of use of bagasse is highly untapped. Table B.7 below further highlights the abundant bagasse availability in the project area, which demonstrates that leakage considerations may be ruled out.

Table B.7 Bagasse Availability in Uttar Pradesh

<table>
<tr><th>Sr. No.</th><th>Parameter</th><th>Value</th><th>Reference / Remarks</th></tr>
<tr><td>1.</td><td>Potential Power generation capacity of bagasse based power plants with surplus bagasse available in the region</td><td>1080 MW</td><td>As per the information available on MNES web site (14/12/2004)</td></tr>
<tr><td>2.</td><td>Installed Power generation capacity of existing bagasse based power plants</td><td>80 MW</td><td>As per information available on NEDA’s web site (14/1/2005)</td></tr>
<tr><td colspan="4">Therefore only 7.4% of the total potential of 1,080MW of power based on bagasse has been achieved. There is abundant bagasse available in Uttar Pradesh state so as to enhance 1000MW of power from this renewable energy source. This clearly implies the abundance availability of surplus bagasse. Further
- Surplus supply of bagasse (for which there is no use) is 12.5 times the bagasse used for power generation (which includes both in house power requirements and export to grid)
- The surplus supply of bagasse referred to here does not include bagasse consumed for conventional purposes.</td></tr>
</table>

Therefore it may be concluded that since there is plenty of surplus bagasse (biomass) in the region, the there will be no emissions associated to leakage (L_y= 0). However the same will be verified in each year of the crediting period.

Emission reductions due to displacement of grid-electricity

The emission reductions due to displacement of grid-electricity by the zero-GHG HCM project activity are calculated based on the annual quantum of electricity that would be generated by the HCM project activity (EG_y) over and above the annual electricity that would be generated in the Reference Plant of the baseline scenario and the CO_2 Emission Factor ($EF_{electricity,y}$) for the baseline electricity displaced due to the project activity in the Northern Regional grid, summed over the crediting period. The equation is as follows:

$$ER_{electricity,y} = EG_y \cdot EF_{electricity,y}$$

where:

$ER_{electricity,y}$	are the emission reductions due to displacement of electricity during the year *y* in tons of CO_2,
EG_y	is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year *y* in MWh,
$EF_{electricity,y}$	is the CO_2 emission factor for the electricity displaced due to the project activity during the year *y* in tons CO_2/MWh.

Step 1: Determination of $EF_{electricity,y}$

The determination of the emission factor for displacement of electricity $EF_{electricity,y}$ depends on the type of project activity and the baseline scenario identified and should be determined as follows:

The project activity displaces electricity from other grid-connected sources (P4). The emission factor for the displacement of electricity should correspond to the grid emission factor ($EF_{electricity,y} = EF_{grid,y}$) and $EF_{grid,y}$ shall be determined as follows:

Since the power generation capacity of the bagasse-based power plant is of more than 15 MW, $EF_{grid,y}$ should be calculated as a combined margin (CM), following the guidance in the section "Baselines" in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

The HCM project activity exports electricity to the state grid of Uttar Pradesh, UPPCL which is a part of the Northern Regional Grid. The CO_2 baseline emission factor of Northern Regional Grid, has been calculated as Combined Margin [average of the Operating Margin, calculated as 3-year average, based on 2002-2003, 2003-2004 and 2004-2005 (the most recent statistics available) and Build Margin, calculated for the most recent year, 2004-2005] following the guidelines provided in ACM0002.

The equations for the CO_2 baseline emission factor are as follows :

STEP 1. Calculate the Operating Margin emission factor

Simple OM: The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the Northern Regional Grid system, not including low-operating cost and must-run power plants:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \, x \, COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as given below and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as given below

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from other grid

The Fuel Consumption $F_{i,j,y}$ is obtained as

$$\sum_{i} F_{i,j,y} = \left(\sum_{j} GEN_{j,y} \otimes 860 \Big/ NCV_i \otimes E_{i,j} \right)$$

where

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i

$E_{i,j}$ is the efficiency (%) of the power plants by source

1 kWh = 860 kCal

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

where

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ is the oxidation factor of the fuel

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated separately for the most recent three years (2002-2003, 2003-2004 & 2004-2005) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$).

$$EF_{OM,y} = \sum_{y} EF_{OM,simple,y} / 3$$

where y represents the years 2002-2003, 2003-2004 and 2004-2005.

STEP 2. Calculate the Build Margin emission factor

The Build Margin emission factor ($EF_{BM,y}$) has been calculated as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of Northern Regional Grid as per the following Option 1 available in the ACM0002 Version 06.

Option 1: Calculate the Build Margin emission factor EFBM,y ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

The calculation for Build Margin emission factor is furnished below:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \, x \, COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - Are analogous to the variables described for the simple OM method above for plants m.

The sample group m for the most recent year consists of the 33 (thirty three) power plants that have been built most recently, since it comprises of larger annual power generation.

STEP 3. Calculate the Emission Factor of the Grid (EF_{Grid})

The electricity baseline emission factor of Northern Regional Grid, EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = W_{OM} \otimes EF_{OM,y} \oplus W_{BM} \otimes EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

$EF_{grid,y}$ was found to be 916.81 t of CO_2/ MU.

Please refer to "Annex 3: Baseline Information" and Enclosure-I for detailed analysis of the generation mix of Northern Regional Grid and calculation of the grid emission factor.

Step 2: Determination of EG_y

As per the guidance provided by Meth Panel in F-CDM-AM-Rev_Resp_ver 01 - AM_REV_0013, BCML may also consider to only claim emission reductions for using a more efficient boiler in the project case than in the reference plant and for using biomass that would otherwise be dumped and/or left to decay – thus not claiming emission reductions for biomass quantities that are diverted from other feedstock uses (e.g., paper) to the project plant.

EG_y : the net quantity of increased electricity generation as a result of the project activity during the year y, for using a more efficient boiler in the project case than in the reference plant, is determined as per Scenario 4 of the Table 1 of the ACM0006 Version 03. Herein the same type and quantity of biomass as in the project plant would be used in the reference plant and the power generated by the project plant would in the absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the project plant than in the reference plant – (b) partly in power plants in the grid. The heat generated by the project plant would in the absence of the project activity be generated in the reference plant (the heat generated per biomass input in the project plant is smaller or the same compared to the reference plant).

For Scenario 4, EG_y corresponds to the difference between the electricity generation in the project plant associated to the same quantity of baggase and the quantity of electricity that would be generated by other power plant(s) using the same quantity of bagasse that is fired in the project plant:

$$EG_y = EG_{project\ plant,y} - \varepsilon_{el,other\ plant(s)} * \sum_I BF_{i,y} * NCV_i$$

where:

EG_y	is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh,
$EG_{project\ plant,y}$	is the net quantity of electricity generated in the project plant during the year y in MWh,
$\varepsilon_{el,other\ plant(s)}$	is the average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass fired in the project plant in the absence of the project activity, expressed in $MWh_{el}/MWh_{biomass}$
$BF_{i,y}$	is the quantity of biomass type i used as fuel in the project plant during the year y in a volume or mass unit, and
NCV_i	is the net calorific value of the biomass type i in MWh per mass or volume of biomass.

EG_y : the net quantity of increased electricity generation as a result of the project activity during the year y, for using bagasse that would otherwise be burned in an uncontrolled manner, is determined as per Scenario 3 of the Table 1 of the ACM0006 Version 03 wherein the biomass would in the absence of the project activity be dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes and the power generated by the project plant would in the absence of the project activity be generated in the grid.

For Scenario 3, EG_y corresponds to the net quantity of electricity generation in the project plant and is calculated as:

$$EG_y = EG_{project\ plant,y}$$

Transmission and Distribution Losses-As per the guidance in baseline methodology, the transmission and distribution losses in the electricity grid are not influenced significantly by the project activity. They are therefore assumed to be zero.

Emission reductions or increases due to displacement of heat

BCML has not claimed for emission reductions due to heat generation in the project activity but is required to demonstrate that emissions do not arise from combustion of more bagasse.

As per the selected baseline methodology to address this substitution effect for the proposed scenario BCML was required to either:

- Demonstrate that the thermal efficiency in the project plant is larger or similar compared with the thermal efficiency of the plant considered in baseline scenario and then assume $ER_{heat,y}$ = 0, or, if this is not the case; or,
- Account for any increases in CO_2 emissions.

The thermal efficiency in the project plant is larger than the thermal efficiency of the reference plant. Further this increased level of heat generation as a result of the project activity may be generated by different means, such as:

(a) Additional biomass being fired in the project plant, i.e. leading to a higher load factor than in the absence of the project activity;

(b) Increasing or initiating heat generation in boilers fired with the same type of biomass;

(c) Co-firing fossil fuels in the project plant, e.g. in cases where the supply of biomass is limited;

(d) Increasing or initiating heat generation in boilers fired with fossil fuels.

Project participants shall identify how additional heat is generated in the context of the project activity, as follows:

- In the absence of any boilers and of any fossil fuel consumption for power or heat generation at the project site, option (a) shall apply.
- Where biomass boilers fired with the same type of biomass are operated and no fossil fuels are used for power or heat generation at the project site, option (b) shall apply.
- Where fossil-fuels are co-fired in the project plant but not in any boilers, option (c) shall apply.
- Where fossil fuels are fired in boilers, option (d) shall apply.

In the case of (a), the additional heat generation can be assumed not to involve additional emissions and $ER_{heat,y} = 0$. In case of (b), emission reductions due to displacement of heat can be estimated as well as zero as a simplified assumption ($ER_{heat,y} = 0$). In case of (c), increases in CO_2 emissions are considered as project emissions and accounted with equation (6) of ACM0006 given below.

$$PEFF_y = \sum_i FF_{project\ plant,i,y} \cdot COEF_{CO2,i} \quad (6)$$

where:

$FF_{project\,plant,i,y}$ is the quantity of fossil fuel type i combusted in the biomass power plant during the year y, and
$COEF_{CO2,i}$ is the CO_2 emission factor of the fuel type i.

In case of (d), project participants shall account for CO_2 emissions from increased combustion of fossil fuels in the boiler(s) due to the project activity.

In the project activity additional biomass is being fired to generate higher quantum of heat generation for both process steam and for power generation. Since The increased level of heat generation in the HCM project activity is attributed to additional bagasse being fired in the HCM project activity and therefore the additional heat generation can be assumed not to involve additional emissions and $ER_{heat,y} = 0$.

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

(Copy this table for each data and parameter)

The Combined Margin Emission factor, which is the weighted average of the Operating Margin Emission and the Build Margin Emission Factor, for Northern regional grid is calculated as per ACM0002. Data needed to calculate the emission factor are based on information available from authorised government agencies – especially the Central Electricity Authority (CEA) sources. These records are used for Combined Margin emission factor (EF) calculation at the start of crediting period.

Table B.8 Data and parameters for determining the grid emission factor

Data / Parameter:	EF_y
Data unit:	tCO_2/ MWh
Description:	CO_2 emission factor of the grid
Source of data used:	Calculated as weighted sum of OM and BM emission factors
Value applied:	0.9168
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies has been used as per guidelines of ACM0002 methodology. Recording frequency – once at the start of crediting period. Please refer Annex 3 of PDD for details.
Any comment:	

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/ MWh
Description:	CO_2 operating margin emission factor of the grid

Source of data used:	Calculated as indicated in the relevant OM baseline method of ACM0002 using data from official statistics
Value applied:	1.111
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies - has been used as per guidelines of the methodology. Recording frequency – once at the start of crediting period. Please refer Annex 3 of PDD for details.
Any comment:	

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or m^3/year
Description:	Consumption of Fossil fuel by existing grid connected power plants
Source of data used:	Annual Performance Review of Thermal Power Plants; CEA (http://www.cea.nic.in/opm/per_rev.htm)
Value applied:	Varies for each plant. Please refer to Annex 3 for Values
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies has been used as per ACM0002 methodology. Recording frequency – once at the start of crediting period.
Any comment:	Please refer to Annex 3 of PDD for details.

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh/ year
Description:	Electricity generation of each power source/plant
Source of data used:	Annual Reports of Northern Region Electricity Board (NREB) (http://www.nreb.nic.in/Reports/Index.htm)
Value applied:	Please refer Annex 3 of PDD
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies - NREB has been used as per guidelines of ACM0002 methodology. Recording frequency – once at the start of crediting period.
Any comment:	Please refer Annex 3 of PDD for details.

Data / Parameter:	NCV_i
Data unit:	Kcal/kg
Description:	Net calorific value of the fuel combusted in grid based power plants used in the determination of the emission factor.
Source of data used:	Net Calorific Value of Gas : IPCC

	Net Calorific Value of Coal: NATCOM
Value applied:	Varies for each fuel type
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	Please refer Annex 3 of PDD

Data / Parameter:	$COEF_{i,k}$
Data unit:	tCO_2/ TJ
Description:	Tonnes of CO_2 per energy unit of fuel in grid based plants used in the determination of emission factor
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-1.
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values of Emission Factor have been converted to a CO_2 equivalent by multiplying by 44/12.
Any comment:	

Fuel	**Emission factor (tC/TJ)**	**Emission factor (tCO_2/TJ)**
Natural gas	15.3	56.1
Sub-bituminous coal	25.8	94.6

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor applied to the combustion of fuels in grid based plants for determination of emission factor
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-6
Value applied:	98% for coal and 99.5% for gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/ MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data used:	Calculated as indicated in the relevant OM baseline method of ACM0002 using data from official statistics : [∑I Fi,y*COEFi]/ [∑mGENm,y] over recently built power plants defined in the ACM0002 baseline methodology
Value applied:	0.722
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies - Central Electricity Authority (CEA) has been used as per guidelines of ACM0002 methodology. Recording frequency – once at the start of crediting period. Please refer to Annex 3 of PDD for details.
Any comment:	

Data / Parameter:	$F_{i,m,y}$
Data unit:	t or m^3/year
Description:	Consumption of Fossil fuel by existing grid connected power plants
Source of data used:	Annual Performance Review of Thermal Power Plants; CEA (http://www.cea.nic.in/opm/per_rev.htm)
Value applied:	Varies for each plant. Please refer to Annex 3 for Values
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies - Central Electricity Authority (CEA) has been used as per ACM0002 methodology. Recording frequency – once at the start of crediting period.
Any comment:	Please refer to Annex 3 of PDD for details.

Data / Parameter:	$GEN_{m,y}$
Data unit:	MWh/ year
Description:	Electricity generation of each power source/plant
Source of data used:	Annual Reports of Northern Region Electricity Board (NREB) (http://www.nreb.nic.in/Reports/Index.htm)
Value applied:	Please refer Annex 3 of PDD
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies - NREB has been used as per guidelines of ACM0002 methodology. Recording frequency – once at the start of crediting period.
Any comment:	Please refer Annex 3 of PDD for details.

Data / Parameter:	$\varepsilon_{el,other\ plant(s)}$
Data unit:	$MWh_{el}/MWh_{biomass}$
Description:	Average net efficiency of electricity in the reference plant
Source of data used:	Calculated from the consumption of biomass and electricity in the reference plant
Value applied:	.043
Justification of the choice of data or description of measurement methods and procedures actually applied :	The calculation has been carried out on the basis of a similar unit of BCML.
Any comment:	Please refer to Annex 3 for further details.

B.6.3 Calculation of emission reductions:

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The calculation of the emission reductions from the HCM project activity is as follows:

$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$

where:

ER_y are the emissions reductions of the project activity during the year y in tons of CO_2,
$ER_{electricity,y}$ are the emission reductions due to displacement of electricity during the year y in tons of CO_2,
$ER_{heat,y}$ are the emission reductions due to displacement of heat during the year y in tons of CO_2,
$BE_{biomass,y}$ are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,
PE_y are the project emissions during the year y in tons of CO_2, and
L_y are the leakage emissions during the year y in tons of CO_2.

Table B.9 Data inputs for emission reduction calculations

Parameter	Value	Comments
$ER_{heat,y}$	0	The increased level of heat generation as a result of the project activity is generated due to increased thermal efficiency and due to additional biomass being fired in the project plant, and therefore it does not involve additional emissions and $ER_{heat,y} = 0$
$ER_{electricity,y}$		
EF_y	0.916	As per ACM0002 Version 06; Data Unit: TCO_2/MWh

EG_y: Scenario 4		
$\varepsilon_{el,oter\ plant}$	.043	Data Unit: $MWh_{el}/MWh_{Biomass}$
$BF_{i,y}$	127102	Data Unit: Ton
NCV_i	2272	Data Unit: kcal/kg
EG_y	56521.42	Data Unit: MWh
EG_y: Scenario 3		
EG_y	27525.41	Scenario 3; Data Unit: MWh
Total EG_y	**84046.84**	
$ER_{electricity,\ y}$	**76986.9**	
$BE_{biomass,\ y}$	0	Excluded
PE_y	0	Refer to Section B.6.1
L_y	0	Refer to Section B.6.1

B.6.4 Summary of the estimated emission reductions:

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Year	Estimation of Project activity Emission reductions (tonnes of CO_2e)	Estimation of baseline Emissions reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2e)
Year 1	0	59806.7	0	59806.7
Year 2	0	76986.9	0	76986.9
Year 3	0	76986.9	0	76986.9
Year 4	0	76986.9	0	76986.9
Year 5	0	76986.9	0	76986.9
Year 6	0	76986.9	0	76986.9
Year 7	0	76986.9	0	76986.9
Year 8	0	76986.9	0	76986.9
Year 9	0	76986.9	0	76986.9
Year 10	0	76986.9	0	76986.9
Total (tonnes of CO_2e)	**0**	**752688.8**	**0**	**752688.8**

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

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The project activity follows the following baseline methodology:

- Version 03 of ACM0006: "Consolidated monitoring methodology for grid-connected electricity generation from biomass residues"

In line with the application of the methodology, the project also draws on elements of the following methodologies:

- Version 06 of ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{project\ plant,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant during the year y.
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	130498.8
Description of measurement methods and procedures to be applied:	The project activity has installed a DCS system to measure the data accurately. The digital meters are used to ensure high accuracy level. The uncertainty of the data is considered to be low as the monitoring equipment is of reputed make and of high accuracy level.
QA/QC procedures to be applied:	Yes. The following practices are followed in the plant to ensure the reliability of the data: 1. The parameter is monitored continuously in a PLC system. The consistency of metered net electricity generation can be cross verified with receipts of export and the quantity of biomass fired. 2. The daily report (which includes total electricity generated) prepared by the Electrical Department of HCM is presented by Assistant General Manager (Electrical) or Divisional Manager (Electrical) in the morning meeting in presence of all the departmental heads. The meeting is chaired either by General Manager (Works). Discrepancy, if identified, is addressed immediately. 3. The monthly report (which includes total electricity generated) is also discussed and reviewed in the morning meetings and the Management Review

	Meeting conducted every three months. Discrepancy, if identified, is addressed immediately. 4. Manager In-charge would be responsible for calibration of the meters as per national standards.
Any comment:	

Data / Parameter:	$EG_{projectplant,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated associated to improved efficiency during the year y.
Source of data to be used:	Plant log book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	56521.42
Description of measurement methods and procedures to be applied:	Calculated for Scenario 4 based on the continuously measured electricity generation data and the biomass quantum used.
QA/QC procedures to be applied:	Not applicable
Any comment:	

Data / Parameter:	$EG_{projectplant,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated from use of decay biomass during the year y.
Source of data to be used:	Plant log book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	27525.41
Description of measurement methods and procedures to be applied:	Calculated for Scenario 3 based on the continuously measured electricity generation data and the biomass quantum used.
QA/QC procedures to be applied:	Not applicable
Any comment:	

Data / Parameter:	Q_y
Data unit:	MWh
Description:	The quantity of increased heat generation in the project plant
Source of data to be used:	Plant log book
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:	Calculated
QA/QC procedures to be applied:	Not applicable
Any comment	The net heat generation is calculated and any condensate return is subtracted.

Data / Parameter:	$BF_{i,y}$
Data unit:	Mass or volume unit
Description:	Quantity of biomass type i combusted in the project plant during the year y
Source of data to be used:	Onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	B2: Total Annual Bagasse Consumption in Reference Plant: 127102 B1:Total Annual Bagasse sent for uncontrolled burning: 61897
Description of measurement methods and procedures to be applied:	The total bagasse generated at HCM Sugar Plant will be measured continuously. B1 and B2 bagasse quantum will be calculated based on the monitored data $BF_{i,y}$
QA/QC procedures to be applied:	Yes. Direct measurements with mass meters at the plant site will be cross verified against the production and the annual energy balance that is based on purchased quantities and stock changes. Manager In-charge would be responsible for calibration of the meters as per national standards.
Any comment	The quantity of biomass combusted will be collected separately for all types of biomass residues.

Data / Parameter:	NCV_i
Data unit:	MWh/t
Description:	Net calorific value of bagasse and fossil fuel type I if any.
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2.6418
Description of measurement methods and procedures to be applied:	In-house and Third Party monitoring will be conducted.
QA/QC procedures to be applied:	Yes. Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment	The net calorific value will be determined separately for all types of biomass residues.

Data / Parameter:	$BF_{i,y}$
Data unit:	Mass or volume unit
Description:	Quantity of biomass type i for which leakage could not be ruled out using one of the approaches in the baseline methodology.
Source of data to be used:	Onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Meter reading, Electronic/paper recording, recording frequency – annual
QA/QC procedures to be applied:	Yes. Direct measurements with mass meters at the plant site will be cross checked with an annual energy balance that is based on purchased quantities and stock changes. Manager in-charge would be responsible for calibration of the meters as per national standards.
Any comment	-

Data / Parameter:	$COEF_i$
Data unit:	TCO_2/MWh
Description:	CO_2 emission coefficient for most intensive fuel in the calculation of combined margin with methodology ACM0002.
Source of data to be used:	CEA or IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value of the data will be determined annually if it cannot be demonstrated that the project does not give rise to leakage.
Description of measurement methods and procedures to be applied:	Measured or local/ national data will be used preferably. Default values from the IPCC may be used in absence of local/national data.
QA/QC procedures to be applied:	-
Any comment	-

Data / Parameter:	
Data unit:	Volume or mass unit
Description:	Amount of biomass of type i fired in all grid connected plants in the region/country.
Source of data to be used:	Official data (dispatch center, statistics, relevant publications, etc.) or third party survey.
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:	Measured or calculated, recording frequency annual
QA/QC procedures to be applied:	Yes. Where possible, supplementary data sources and expert judgements should be used to support the findings.
Any comment	

Data / Parameter:	$BF_{y,surplus}$
Data unit:	Volume or mass unit
Description:	Quantity of biomass of type i that is available in surplus in the region/country.
Source of data to be used:	….

Value of data applied for the purpose of calculating expected emission reductions in section B.5	Official data (statistics, relevant, publications, etc.) or an own survey will be conducted.
Description of measurement methods and procedures to be applied:	Measured or calculated, recording frequency annual
QA/QC procedures to be applied:	Yes. Where possible, supplementary data sources and expert judgements should be used to support the findings.
Any comment	The quantity of surplus supply is the difference between available biomass and biomass used for other purposes than grid connected electricity generation.

B.7.2 Description of the monitoring plan:

The aim is to enable the HCM project activity to 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 the project outcomes, impacts and actual greenhouse gas (GHG) emission reductions.

The project revenue is based on the units generated by the project activity, the units sent to HCM Sugar plant and the units exported to grid as measured by power meters at plant and check meters at the high-tension substation of the UPPCL. The monitoring and verification system mainly comprise of these electricity meters and bagasse generation and utilization. The export of electricity may be verified through invoices to UPPCL. The invoices, based on the official meter readings, will also be covered in the regular finance audit. The bagasse input is also to be monitored. The measurement of the quantity of bagasse used will produce evidence that the energy is being generated with zero net CO_2 emissions.

The HCM project activity has employed the latest state of art monitoring and control equipment that measure, record, report, monitor and control various key parameters (see Section B,7,1). These monitoring and controls are a part of the Distributed Control System (DCS) of the entire plant. All monitoring and control functions have been done as per the internally accepted standards and norms of HCM, which are based on national and international industry standards.

The instrumentation system of the HCM project activity comprises of microprocessor-based instruments of reputed make with the requisite level of accuracy. All instruments are calibrated and marked at regular intervals according to accepted industry standards so that the accuracy of measurement can be ensured all the time.

Project Parameters affecting Emission Reduction

[A] Electricity Generation

Frequency of monitoring

The project developer has installed all metering and check metering facilities within the plant premises as well as in the grid substation to determine the additional electricity generated due to the project activity. The measurements are recorded and monitored on a continuous basis by both UPPCL and the project developer through DCS.

Reliability

The amount of emission reduction units is proportional to the additional energy generation from the project activity. Thus the KWh meters reading is the final value from project side. All measurement devices are of microprocessor based with best accuracy and have been procured from reputable manufacturers who adhere to international standards of accuracy. Since 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 power measuring instruments will be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Therefore the system ensures the final generation is highly reliable.

Registration and reporting

Registration of data is on-line in the control cabin through a microprocessor. However, hourly data logging will be there in addition to the software memory. Daily and monthly reports are prepared stating the generation. In addition to the records maintained by the HCM, UPPCL also monitors the power exported to the grid to certify the same.

The other major factors, which need to be ensured and monitored, are: the use of only bagasse (and if required biomass) fuel for power generation and the parameters that would ensure smooth and regular operation of the cogen set. No other project specific indicators are identified that affect the emission reductions claims.

[B] Bagasse Requirement and Utilization

The total amount of bagasse received from the Haidergarh and Babhnan unit will be based on the total sugar cane crushing, bagasse generated and use for internal consumption.

Quantity of the Bagasse fuel used in the boiler

The fuel is first dumped in the fuel storage area from where it is taken to the fuel processing machinery. The fuel processing machinery cuts the bagasse fuel into the required size and the processed bagasse fuel will be taken to boiler bunkers with the help of belt conveyors from where the fuel finally enters the boiler. The belt conveyors which feed the bagasse fuel from processing machinery to boiler bunkers consists of a metal detector, tramp iron detector, magnetic separator and online weighing system. Metal detector, tramp iron separator etc. prevent any metal particles entering into the boiler and ensure that only fuel is conveyed to the boiler. An online weighing system provided to the belt conveyors measures, records and transmits the actual quantity of the fuel entering into the boiler for online monitoring in the DCS. The weighing system is calibrated regularly to ensure the accuracy of the measurement. The data will be recorded for further verification.

Since it is mandatory for sugar industries to submit official yearly performance records (RT-8C form), which also includes the above parameters, to the government, the plant metered figures are to be cross-checked against this additional record.

Quantity of the additional biomass fuel from Other Units

HCM maintains proper records of additional biomass if bought from outside the plant premise and will be kept open for verification. The quantity of the fuel received / purchased will be measured, recorded and monitored from the starting point in the project i.e. at the entry of the project premises. The project developers have installed a computerized weighing system through which each truck of the fuel will pass through. The information of each truck of bagasse/biomass fuel will be monitored by promoters regularly, through computerized management information systems. No truck with bagasse/biomass fuel will be able to enter into the plant without weighing the fuel. The weighing system will be calibrated and sealed regularly as per the prevailing practices.

Bagasse used in the boiler

The main type of fuel proposed for the power generation is only bagasse. The properties of the bagasse fuels like ultimate analysis, calorific value, ash composition etc. are already established and will be consistent in the region. However, it is proposed to monitor various properties of the bagasse fuels by taking samples at random from the fuel lots of the processed fuel so that, in case of any drastic change in the properties, corrective actions can be taken. The measurement of fuel properties like ultimate analysis, calorific value etc. will be done at reputable laboratories as per international practices, and data or documents will be kept open for the DOE verifiers. The data will also be computerized and monitored through management information system of the DCS.

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

>>

04/09/06;

BCML and their consultant;

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:

>> 20/10/02

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

>>20 y

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:

>> Not applicable

C.2.1.2. Length of the first crediting period:

>> Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/11/03

C.2.2.2. Length:

>> 10 years

SECTION D. Environmental impacts

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D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The HCM project activity is set up adjacent to the Haidergarh Chini Mills, a sugar-manufacturing unit at Haidergarh. An Environmental Impact Assessment was conducted before the HCM project activity implementation with minor additional mitigating measures identified in the Environment Management Plan (EMP) to further minimize the net impact. BCML has implemented the all the mitigation measures recommended in the EMP, in order to reduce the environment impacts, which were assessed during the EIA study conducted before the HCM project activity was implemented.

The summary of the Environmental Impact Assessment and Environment Management Plan developed before HCM project activity implementation has been given below:

The environmental impacts due to HCM project activity are envisaged in two distinct phases:

- During the construction phase and
- During the operation phase

IMPACTS DURING CONSTRUCTION
The impacts during the construction phase are regarded as temporary or short term and hence do not have an everlasting affect on the environmental quality of the area. However the following factors given below under the EMP are important to minimize the impacts. The impacts envisaged during the construction of the HCM project activity are:
<u>Impact on Land use and Hydrology</u> Due to the *terai* region, the water level is very high. The pumping of ground water will help in lowering the water level in the factory area. The Sugarcane requires large quantities of water for irrigation. 59% of area is irrigated by tube-wells and increase sugarcane crop will help in bringing down the water table.

Environment Management Plan – Not Applicable
Impact on Terrestrial Ecology The proposed land selected for HCM project activity is barren and there is no requirement to clear the land. No deforestation is required. There is no negative effect of the HCM project activity on the terrestrial ecology of the area. Environment Management Plan - Deforestation Although the site is not endowed with trees and vegetation, in order to avoid felling of trees in the vicinity, the construction site workers should be assisted in procuring fuel for cooking purposes in order to avoid felling of any trees in the neighbourhood. The project site will also be extensively landscaped with the development of green belt consisting of variety species, which would enrich the ecology of the area.
Impact on Aquatic Ecology There is no tank, lake, river or surface water body very close to the project site. Hence no impact is envisaged in the construction phase on the aquatic ecology of the area. Environment Management Plan – Not Applicable
Demography and Socio-Economics Land has been purchased from local villages for which proper price has been paid. Some efforts are necessary to resettle their families. The establishment of the factory will prove highly beneficial to the rural population neighbouring the site. There will be a marginal increase in the employment of some persons living in the nearby villages both at the time of construction as well as during operation. Environment Management Plan – Not Applicable
Traffic and Traffic Hazards for Access Roads During construction phase, the building material, equipment and machinery and labour will be transported to the site and this will increase the volume of traffic on access roads. However this effect will not be very significant in view of the fact that the construction activities will be spread over a period of 10 months.

Environment Management Plan – Not Applicable
Impact on Land Environment During construction the impacts are generally manifested by loss of minor vegetative cover, and the migration of minor avian population restricted to the site. Environment Management Plan As soon as construction is over the surplus earth has to be utilized to fill up low-lying areas, the rubbish will be cleared and all un-built surfaces reinstated. There are no trees at the present site hence no felling of trees is involved. Appropriate vegetation will be planned after construction activity. After a green belt development these will be mitigated and the avian population will increase after the green belt development since there are no tress presently. Development of the green belt is to be taken up along with civil works.
Impact on Ambient Air Quality No major levelling operations are required during site preparation. However during dry weather conditions, there would be some fugitive emissions associated to site preparation. There will be an increase in emissions due to increased transportation activities. Environment Management Plan It is necessary to control the dust generated by excavation and transportation activities. At the site such activity will be carried out after water sprinkling. It should be ensured that both gasoline and diesel powered vehicles are properly maintained to minimize smoke in the exhaust emissions.
Impact on Noise The impact of noise on the nearest inhabitants during the construction activity will be negligible. Environment Management Plan However it is advisable that on site workers using high noise equipment wear noise protection devices like ear muffs. Noise prone activities have to be restricted to the extent possible during night particularly during the period 10 p.m. to 6 a.m. in order to have minimum environmental impact.
Impact on Soil due [I] Storage of Hazardous Materials

The following hazardous materials are anticipated to be stored at site during construction:

- Petrol and Diesel
- Painting materials

Spillage and/or leakage of the stored chemicals could lead to soil contamination.

Environment Management Plan

These materials should be stored in drums as per international safety norms.

The vehicle maintenance area should be located in such a manner to prevent contamination of surface and ground water sources by accidental spillage of oil. Unauthorized dumping of waste oil should be prohibited.

[II] Sanitation

Improper sanitation facilities could lead to unhygienic conditions and soil contamination.

Environment Management Plan

The construction site should be provided with sufficient and suitable toilet facilities for workers meeting the proper standards of hygiene. These facilities should preferably be connected to a septic tank and maintained to ensure minimum environmental impact.

IMPACTS DURING OPERATION

The operational phase will involve power production using bagasse. The following activities in relation to the operational phase will have varying impacts on the environment and are considered for impact prediction.

Impact on Ambient Air Quality

The EIA study establishes that the existing status of the ambient air quality of the area is well within the national ambient air quality standard.

[A] Stack Emissions

The pollutants envisaged from the HCM project activity are Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_x), Carbon mono-oxide (CO) and CO_2.

As such the bagasse has very low ash content (1.5%). There will not be any sulphur di-oxide (SO_2) emissions, as bagasse does not contain sulphur. Moisture content of 50% in bagasse will keep the burner temperatures low so that NO_X formation will not take place. Similarly the high efficiency combustion is envisaged so that CO formation does not take place and the CO_2 gets absorbed by the sugar canes harvested each year.

The predictions for air quality during operation phase were carried out for suspended particulate matter, concentrated for using Air Quality model "Industrial Source Complex Version 99155 (ISCST3)" developed by the US Environmental Protection Agency in 1995 for atmospheric dispersion of stack emissions from point source (Details provided in the EIA Report). The maximum predicted ground level concentrations for SPM were 3.14 ug/m^3 and these were observed in the North-North-West at a distance of 2.2 km. This shows that with the proposed EMP the air quality impacts of the HCM project activity's operation phase are reduced to a minimum.

Environment Management Plan

The SPM as ash is controlled by a high efficiency Electro-Static Precipitator (ESP). High efficiency (> 99%) ESP will ensure SPM levels are less than 150 mg/Nm^3 in the stack.

The air pollution from the HCM project activity in the form of particulate matter emitted mainly from the boiler will be well within the prescribed norms and hence no further mitigation measures are envisaged. In case of non-availability of bagasse, is envisaged to be used as fuel. Considering biomass has on average more ash content (17%) against the 1.5% of bagasse fuel, the ESP needs to be fine tuned so that stack emissions remains within limits. To reduce the ground level concentrations of the pollutants still further, a 72 m high R.C.C. stack height is proposed. This will further help is fast dispersion of pollutants into the atmosphere, thus, reducing their impact in the vicinity of the project area.
Impact on Soil Most of the impacts on soil due to the HCM project activity are negligible and restricted to the construction phase and will get stabilized during the operational phase. The waste pollutants envisaged from the HCM project activity are fly ash from the ESP, bottom fly ash and some oily wastes. Environment Management Plan Fly ash collected from the ESP hoppers and air heater hoppers and the ash collected from the furnace bottom hoppers can be used as landfills and also as fertilizers in the sugar cane fields. The ash content in the bagasse is less than 2%. The total fly ash collected may be mixed with press mud from the sugar plant and sold to farmers as manure because of its high nutrient value. The boiler soot after cleaning should be stored in a closed drum and to be disposed properly. Similarly the oily waste, cloth *etc.* should be stored in a drum and disposed properly.
Impact On Water Resources The HCM project activity's water requirement would be met by the ground water resources. This is considering abundant ground water with continuous recharge is available. Environment Management Plan – Not Applicable

Impact on Noise

For assessing the impact of noise during operation phase, considerations have been given to two aspects, those relating to the noise sources and the other relating to potential receivers.

The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure levels with distance from the source is expected due to atmospheric effect in its interaction with objects in the transmission path. Hence, the maximum exposure of noise is when a person is at line of sight from the noise-generating source.

In the HCM project activity continuous and very high noise levels would be generated near the primary air fans, forced drafted fans, boilers, generators, compressors and pumps.

For computing the noise levels at various distances with respect to the plant site in general and the turbo-generator bay in particular, a noise propagation analysis was undertaken. The noise computed at a far distance of about 1000m is of the order of 35dB(A) during the operation of the plant. The ambient noise level recorded in the nearby villages ranges between 40-55 dB(A). (Details provided in the EIA Report) Due to masking effect, the ambient noise levels in the nearby villages will not increase during the operation phase.

The noise levels in the work areas like generator room and boiler room may be slightly on the higher side (>85dB(A) continuously) but at these places, continuous attendance of workers is not required and workers will be on duty only in shifts as required.

<u>Environment Management Plan</u>

Plant equipments are designed to keep noise levels less than 90 dB(A). This is considering damage risk criteria as enforced by OSHA (Occupational Safety and Health Administration) to reduce hearing loss, stipulates that noise level up to 90 dB(A) are acceptable for 8 hour working shift per day.

Provision of protective personnel equipment in addition will reduce the impact of noise level. Hence these noise levels may not be of much concern from occupational health point of view. However under the general health check-up scheme as per factory act, a trained doctor will check up the workers for any Noise Induced Hearing Loss (NIHL).

The greenbelt, which is being provided by BCML, will act as noise attenuator for the nearby area.

Impact on Water Quality

The EIA study establishes that the existing status of the water quality of the area are well within the environmental norms.

The liquid effluents from the power plant would include effluent generated from DM water treatment plant, boiler blow down, cooling tower blow-down, floor washings, sanitation etc.

- Effluent from DM Plant: Hydrochloric acid and sodium hydroxide will be used as regenerants in the DM water plant for boilers and effluent would be drained into epoxy lined underground neutralizing pits. Generally, these effluents are self neutralizing, however provisions will be made such that the effluents are completely neutralized by addition of acid/alkali. The effluent would then be pumped into the effluent treatment ponds, which are a part of the effluent disposal system.
- Effluent from RO Plant: The wastewater generated from Reverse Osmosis (RO), which by design will have less than 2100 mg/l Total Dissolved Solids (TDS) will be sent to sugar factory ETP
- Effluent from Boiler: The salient characteristics of the blow down water from the point of view of pollution would mainly be the pH and temperature since the suspended solids are negligible. The pH would be in the range of 9.8 to 10.3 and the temperature would be around 100 ^{o}C. The quantity of the blow down water is as low as 1.2 tones/hr it is proposed to put the blow down into the trench and leave it into the sugar plant effluent ponds.

Environment Management Plan

The effluent generated from the sugar plant and the HCM project activity will be treated in the effluent treatment plant to ensure there is no environmental deterioration. Therefore there are no major impacts envisaged due to effluent generation from the HCM project activity.

Impact on Ecology

The inventory on terrestrial ecology has been compiled through data collection from marshes, irrigation canals, agricultural land and groves (Details provided in the EIA Report). Air emissions from the plant are very low as mentioned above. SPM will contain primarily ash with high nutrient value and will be beneficial to the plants. Other pollutants like NO_X and CO are not envisaged in much quantity to adversely affect the plants or animals.

There are no liquid discharges from the plant that will interfere with the local aquatic ecological system. High TDS water (<2100 mg/l) will get diluted and will not deplete the dissolved oxygen levels if reaches to water body, even though it will be discharged on the land.

Environment Management Plan - Ecology and Green belt Development

Implementation of afforestation program is of paramount importance for any industrial development. In addition to augmenting green cover, it also checks soil erosion, marks the climate more conductive, restores water balance and makes ecosystem more complex and functionally more stable. The proponents are proposing for an extensive program for the development of green belt around the plant. The green belt is being proposed for the following objectives:

- Mitigation of fugitive dust emissions including any odor problems
- Noise pollution control
- Controlling soil erosion
- Balancing eco-environment
- Aesthetics

The tree species selected for green belt would include the native species like *Mohua, Dhak, Neem, Mango, Barad etc*. The treated sewage effluent from the plant would be used for watering the green belt.

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:

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Host Country regulations require BCML to conduct an Environment Impact Assessment and develop an Environmental Management Plan to combat any proposed environmental impacts envisaged due to HCM project activity before project implementation. A combined Environment Impact Assessment was conducted for the Haidergarh Chini Mills sugar-manufacturing unit (3,500 TCD) and HCM project activity. The EIA was carried out to understand if there were any significant environmental impacts and the EMP was prepared to minimise adverse environmental impact. The study indicated that the envisaged environmental impacts for the HCM project activity were not significant. The EIA & EMP were submitted to UPPCB for environmental clearance. The HCM project activity received all the necessary environmental clearances before HCM project activity implementation in 2003.

SECTION E. Stakeholders' comments

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

The HCM project activity received BCML management approval on 20th October 02. Soon thereafter, BCML identified the major stakeholders of the HCM project activity in order to get their views and concerns on the implementation of the HCM project activity.

The stakeholders identified for the HCM project activity were:.

- Elected body of representatives administering the local area (Village Panchayat)
- Non-Governmental Organisations (NGOs)
- Consultants
- Equipment Suppliers
- Uttar Pradesh Power Corporation Limited (UPPCL)
- Uttar Pradesh Electricity Regulatory Commission (UPERC)
- Uttar Pradesh Pollution Control Board (UPPCB)
- Environment Department, Government of Uttar Pradesh

Stakeholders list included the government and non-government parties, which were expected to be involved in the HCM project activity at various stages. HCM applied/communicated to the relevant stakeholders to get the necessary clearances and comments.

BCML thereafter shared the salient information of the HCM project activity with all the stakeholders enlisted above. BCML gave a Public Notice of their plan to implement the HCM project activity and distributed pamphlets on the HCM Project activity brief to the local villagers, Village Panchayat and the NGOs to receive their comments. BCML representatives also met the local NGOs and apprised them about the HCM project activity and sought their support for the project. BCML also sent applications to all the government parties to get their opinions on the HCM project activity and attain the necessary approvals and clearances necessary for project implementation.

E.2. Summary of the comments received:

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Non-government parties

The village Panchayat /local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, BCML took encouragement at their consent to set up the HCM project activity. BCML has already completed the necessary consultation and documented for their approval for implementing the HCM project activity.

Local population comprises of the local people in and around the project area. The roles of the local people are primarily as a beneficiary of the HCM project activity. They were to supply raw material *i.e.* sugar cane for sugar mills (with bagasse as by product) and biomass (if required) for cogen plants. In addition to this, it also included local manpower that would be working at the plant site. The HCM project activity was providing good direct and indirect employment opportunities. In addition, the local population would also be an indirect consumer of the power that is supplied from the HCM project activity. This is essentially because the power sold to the grid is expected to improve the stability in the local electricity network. Since, the distance between the electrical substation for power evacuation and the plant is not very high, installation of transmission lines will not create any inconvenience to the local population.

Further, the HCM project activity did not require any major displacement of any local population. The project activity was set up on a barren land that had been purchased from the farmers.

The local populace realized that the implementation of the HCM project activity was not going to cause any adverse social impacts on local population but would contribute to improvise their quality of life. Therefore, BCML received strong support from the local populace during the HCM project activity implementation.

The local NGOs also provided all the necessary support, which BCML sought for the HCM project activity implementation.

Project consultants and equipment suppliers too were direct beneficiaries of the project and provided full support to make the project successful. The Project Consultants were involved in the HCM project activity to take care of various pre contract and post contract project activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment suppliers provided the equipments as per the specifications finalized for the HCM project activity and were responsible for successful erection & commissioning of the same at the site.

Government parties

BCML has received the major necessary approvals and consents from various authorities, required for project implementation like Uttar Pradesh Electricity Regulatory Commission, Uttar Pradesh Power Corporation Limited and the Uttar Pradesh State Pollution Control Board.

Uttar Pradesh Pollution Control Board (UPPCB) and Environment Department of Government of Uttar Pradesh have prescribed standards of environmental compliance and monitor the adherence to the standards. The HCM project activity has received the No Objection Certificate (NOC) from UPPCB prior to commissioning of the plant. HCM project activity has also received the UPPCB's 'Consent to Operate'.

The Uttar Pradesh State's apex body of power is the Uttar Pradesh Electricity Regulatory Commission (UPERC) and BCML has received their written consent for the installation of co-generation power plant of 20 MW capacity under section 21 (4) of UP electricity reform act 1999 read with section 44 of the Indian Electricity Supply Act 1948.

As a buyer of the power, the UPPCL is a major stakeholder in the HCM project activity. UPPCL has cleared the HCM project activity and signed the Power Purchase Agreement (PPA) with BCML for the power exported to the grid.

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

The relevant comments and important clauses mentioned in the project documents/clearances like the Detailed Project Report (DPR), environmental clearances, power purchase agreement, local clearance etc. were considered and adjusted for while preparation of the CDM project and its design document.

The HCM project activity has received positive comments from the non-government parties. The HCM project activity has complied with all the applicable conditions detailed in the consents and agreements.

As per UNFCCC requirement the PDD will be published at the validator's/UNFCCC web site for public comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Table-1-1: Project Proponent	
Organization:	Haidergarh Chini Mills, a unit of Balrampur Chini Mills Limited
Street/P.O.Box:	Village:Pokhra, Tehsil: Haidergarh; Dist: Barabanki
Building:	
City:	
State/Region:	Uttar Pradesh
Postfix/ZIP:	227301
Country:	India
Telephone:	+91 5244 48213
FAX:	+91 5244 45180
E-Mail:	
URL:	
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Saravagi
Middle Name:	-
First Name:	Vivek
Department:	-
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Table-1-2: Other Parties Involved (Buyer)	
Organization:	The Netherlands represented by its Ministry of Housing, Spatial Planning and the Environment acting through the IFC-Netherlands Carbon Facility ("INCaF") and INCaF's trustee.
Street/P.O.Box:	2121 Pennsylvania Ave NW
Building:	
City:	Washington
State/Region:	DC
Postfix/ZIP:	20433
Country:	USA
Telephone:	202 473 4194
FAX:	202 974 4404
E-Mail:	carbonfinance@ifc.org, mparaan@ifc.org
URL:	www.ifc.org/carbonfinance
Represented by:	Represented by:
Title:	Program Manager
Salutation:	Mr.
Last Name:	Widge
Middle Name:	
First Name:	Vikram
Department:	Carbon Finance, Environmental Finance Group, Environment and Social Development Department
Mobile:	
Direct FAX:	
Direct tel:	202 473 1368
Personal E-Mail:	vwidge@ifc.org

Table-1-3: Other Parties Involved (Annex I Country)	
Organization:	Ministry of Housing, Spatial Planning and the Environment, State of the Netherlands
Street/P.O.Box:	Rijnstraat 8, PO Box 30945,
Building:	
City:	The Hague
State/Region:	
Postfix/ZIP:	2500 GX
Country:	The Netherlands
Telephone:	+31 (0) 70 339 4693 +31 (0) 70 339 1306
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Deputy Director
Salutation:	Mr.
Last Name:	Voet
Middle Name:	van der
First Name:	Joris
Department:	Directorate for Internal Affairs
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for this project.

Annex 3

BASELINE INFORMATION

Grid selection

As per the ACM0002 / Version 06 In large countries with layered dispatch systems (e.g. state/provincial/regional/national) the regional grid definition should be used. India has layered dispatch systems. The project activity exports electricity to UPPCL, Uttar Pradesh which is a part of the Northern Region Grid. As per the guidance provided in ACM0002, the Northern Region grid comprising of Delhi, Punjab, Haryana, Chandigarh, Rajasthan, Jammu & Kashmir, Uttaranchal, Uttar Pradesh and Himachal Pradesh has been chosen as the grid system for the project activity.

Key parameters with their data sources

S No.	Key parameters	Data sources
1.	Generation data for all plants for the year 2002-03, 2003-04 and 2004-05(kWh)	Annual Reports of Northern Region Electricity Board (NREB) (http://www.nreb.nic.in/Reports/Index.htm)
2.	Coal consumption	Annual Performance Review of Thermal Power Plants; CEA (http://www.cea.nic.in/opm/per_rev.htm)
3.	Calorific value of gas	IPCC
4.	Calorific value of coal	NATCOM
5.	Oxidation factors	IPCC
6.	Efficiency of gas based power plants supplying power to grid	Emission Baselines-Estimating the Unknown, page 156: by International Energy Agency (www.iea.org/textbase/nppdf/free/2000/embase2000.pdf)

Emission factors

The emission factors are based on IPCC Guidelines for National Greenhouse Gas Inventories and are given below.

Fuel	Emission factor (tC/TJ)	Emission factor (tCO_2/TJ)
Natural gas	15.3	56.1
Sub-bituminous coal	25.8	94.6

Power generation Mix of Northern Region for five years					
Energy Source	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**
Total Power Generation (MU)	134492.7	140515.2	154544.34	168109.84	172681.58
Total Thermal Power Generation	99766.38	104339.7	115985.83	122955.41	126341.00
Total Low Cost Power Generation	34726.33	36175.51	37723.02	44681.92	46340.58
Thermal % of Total grid generation	74.18	74.26	75.05	73.14	73.16
Low Cost % of Total grid generation	**25.82**	**25.74**	**24.41**	**26.58**	**26.84**
% of Low Cost generation out of Total grid generation - Average of the five most recent years 25.88%					**25.88**

Generation details (million kWh)

Name	Type	Fuel	Generation (2002-03)	Generation (2003-04)	Generation (2004-05)
Badarpur TPS	Thermal	Coal	5267.22	5428.96	5462.78
Singrauli STPS	Thermal	Coal	16174.32	15643.40	15803.34
Rihand STPS	Thermal	Coal	7734.09	7949.26	7988.06
Dadri NCTPS	Thermal	Coal	6041.46	6181.12	6842.52
Unchahar-I TPS	Thermal	Coal	3039.51	3252.14	3342.83
Unchahar-II TPS	Thermal	Coal	3103.97	3187.93	3438.28
Tanda TPS	Thermal	Coal	2211.46	2872.81	3254.67
Anta GPS	Thermal	Gas	2757.73	2775.92	2595.77
Auriya GPS	Thermal	Gas	4268.68	4247.41	4119.47
Dadri GPS	Thermal	Gas	5211.55	5058.66	5527.71
Faridabad GPS	Thermal	Gas	2702.02	2792.58	3172.01
Bairasiul	Hydro	Hydel	671.67	687.79	689.67
Salal	Hydro	Hydel	3142.07	3477.42	3443.29
Tanakpur HPS	Hydro	Hydel	421.56	510.99	495.17
Chamera HPS	Hydro	Hydel	2253.53	2648.32	3452.25
Uri HPS	Hydro	Hydel	2448.16	2873.54	2206.71
RAPS-A	Nuclear	Nuclear	1439.31	1293.37	1355.20
RAPS-B	Nuclear	Nuclear	3398.83	2904.68	2954.43
NAPS	Nuclear	Nuclear	3580.38	2959.44	2760.01
Bhakra Complex	Hydro	Hydel	6531.01	6956.90	4546.01
Dehar	Hydro	Hydel	3253.10	3299.29	3150.52
Pong	Hydro	Hydel	763.85	1178.93	882.57
Delhi	Thermal	Coal	1455.83	1164.11	5203.80
SJVNL	Hydro	Hydel	-	1537.92	1617.45
Delhi	Thermal	Gas	2035.15	5159.77	4091.37
Haryana	Thermal	Coal	5867.03	6849.26	7192.41
Haryana	Hydro	Hydel	245.75	251.73	251.73
H.P.	Hydro	Hydel	1598.25	3666.39	3666.39
J&K	Hydro	Hydel	407.09	851.03	851.03
J&K	Thermal	Gas	67.36	15.41	23.51
Punjab	Thermal	Coal	13576.98	14118.96	14390.42
Punjab	Hydro	Hydel	3525.55	4420.43	4420.43
Rajasthan	Thermal	Coal	13826.40	15044.48	17330.79
Rajasthan	Thermal	Gas	218.92	201.37	360.70
Rajasthan	Hydro	Hydel	60.78	494.07	494.07
U.P.	Thermal	Coal	20426.15	20638.05	19788.21
U.P.	Hydro	Hydel	1391.30	2063.04	2063.04
Uttaranchal	Hydro	Hydel	3426.31	3452.96	3452.96
TOTAL			**154544.34**	**168109.84**	**172681.58**

CALCULATION OF BASELINE EMISSION FACTORS-NORTHERN GRID

-	2002-03		2003-04		2004-05	
	Million kWh		Million kWh		Million kWh	
Generation by Coal out of Total Generation	98724.42		102704.29		106451.00	
Generation by Gas out of Total Generation	17261.41		20251.12		19890.00	
Estimation of Baseline Emission Factor (tCO_2/M kWH)	-	-	-	-	-	-
Simple Operating Margin	-	-	-	-	-	-
Fuel 1 : Coal						
Avg. Calorific Value of Coal used (kcal/kg)		4593		4593		4593
Coal consumption (tons/yr)		70,923,000		70,397,000		73,279,000
Emission Factor for Coal-IPCC standard value (tonne CO_2/TJ)		94.6		94.6		94.6
Oxidation Factor of Coal-IPCC standard value		0.98		0.98		0.98
COEF of Coal (tonneCO_2/ton of coal)		1.783		1.783		1.783
Fuel 2 : Gas						
Avg. Efficiency of power generation with gas as a fuel, %		50		50		50
Avg. Calorific Value of Gas used (kcal/kg)		10317		10317		10349
Estimated Gas consumption (tons/yr)		2,877,831		3,376,277		3,305,807
Emission Factor for Gas- IPCC standard value(tonne CO_2/TJ)		56.1		56.1		56.1
Oxidation Factor of Gas-IPCC standard value		0.995		0.995		0.995
COEF of Gas(tonneCO_2/ton of gas)		2.411		2.411		2.419
EF (OM Simple), tCO_2/MU		**1149.96**		**1086.92**		**1097.31**
Average EF (OM Simple), tCO_2/MU						**1111.396718**

Power plants considered for calculating build margin

Plants supplying power to Northern grid are arranged in descending order of date of commissioning
Total generation for 2004-05 = 172681.585
20 % of total generation = 34536.32

	Plant	Date of commissioning	MW	Generation in 2004-2005 (Million kWh)[10]	Fuel Type
1.	Chamera HEP-II (Unit 1)	2003-2004	100	448.02	Hydro
2.	Chamera HEP-II (Unit 2)	2003-2004	100	448.02	Hydro
3.	Chamera HEP-II (Unit 3)	2002-2003	100	448.02	Hydro
4.	SJVPNL	2003-2004	1500	5108.77	Hydro
5.	Baspa-II (Unit 3)	2003-2004	100	398.94	Hydro
6.	Suratgarh-III (Unit-5)	2003-2004	250	1698.37	Coal
7.	Kota TPS-IV (Unit-6)	2003-2004	195	1302.49	Coal
8.	Baspa-II (Unit 1 & 2)	2002-2003	200	797.88	Hydro
9.	Pragati CCGT (Unit II)	2002-2003	104.6	790.21	Gas
10.	Pragati CCGT (Unit III)	2002-2003	121.2	915.61	Gas
11.	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.5	114.19	Gas
12.	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.8	115.11	Gas
13.	Upper Sindh Extn (HPS)(1)	2001-2002	35	32.12	Hydro
14.	Suratgarh stage-II (3 & 4)	2001-2002	500	3396.74	Coal
15.	Upper Sindh Stage II (2)	2001-2002	35	32.12	Hydro
16.	Malana-1 & 2	2001-2002	86	266.08	Hydro
17.	Panipat TPS Stage 4 (Unit-6)	2000-2001	210	1269.31	Coal
18.	Chenani Stage III (1,2,3)	2000-2001	7.5	19.10	Hydro
19.	Ghanvi HPS (2)	2000-2001	22.5	74.06	Hydro
20.	RAPP (Unit-4)	2000-2001	220	1309.70	Nuclea r
21.	Ranjit Sagar (Unit-1,2,3,4)	2000-2001	600	1131.37	Hydro
22.	Gumma HPS	2000-2001	3	4.35	Hydro
23.	Faridabad CCGT (Unit 1) (NTPC)	2000-2001	144	1030.59	Gas
24.	Suratgarh TPS 2	1999-2000	250	1698.37	Coal
25.	RAPS-B (2)	1999-2000	220	1309.70	Nuclea r
26.	Uppersindh-2 HPS #1	1999-2000	35	32.12	Hydro
27.	Faridabad GPS 1 & 2 (NTPC)	1999-2000	286	2046.86	Gas
28.	Unchahar-II TPS #2	1999-2000	210	1559.75	Coal
29.	Unchahar-II TPS #1	1998-1999	210	1559.75	Coal
30.	Suratgarh TPS #1	1998-1999	250	1698.37	Coal
31.	GHGTPLM (Unit 1)	1998-1999	210	1453.23	Coal
32.	GHGTPLM (Unit 2)	1997-1998	210	1453.23	Coal
33.	Tanda TPS (Unit-4)	1997-1998	110	731.54	Coal

[10] http://www.nrldc.org/docs/grmar2005.pdf

Total	**34694.10**
20% of Generation	**34536.32**

CALCULATION OF BASELINE EMISSION FACTORS-NORTHERN GRID

-	2002-03		2003-04		
	Million kWh		**Million kWh**		**Million kWh**
Considering 20% of Gross Generation					
Sector					
Thermal Coal Based					17821.
Thermal Gas Based					5012.
Hydro					9240.
Nuclear					2619.
Total					34694.
Built Margin	-	-	-	-	-
Fuel 1 : Coal					
Avg. calorific value of coal used in Northern Grid, kcal/kg					
Estimated coal consumption, tons/yr					
Emission factor for Coal (IPCC),tonne CO_2/TJ					
Oxidation factor of coal (IPCC standard value)					
COEF of coal (tonneCO_2/ton of coal)					
Fuel 2 : Gas					
Avg. efficiency of power generation with gas as a fuel, %					
Avg. calorific value of gas used, kcal/kg					
Estimated gas consumption, tons/yr					
Emission factor for Gas (as per standard IPCC value)					
Oxidation factor of gas (IPCC standard value)					
COEF of gas(tonneCO_2/ton of gas)					
EF (BM), tCO_2/MU					
Combined Margin Factor (Avg of OM & BM)					
Baseline Emissions Factor (tCO_2/MU)					

Reference Plant Efficiency:

4500 TCD HCM Sugar Plant	
Crushing Season (days)	140
Non-crushing season (days)	160
Bagasse Generation (Tons) at HCM	189000
Net Power Requirement for CS (MW)	4.3125
Net Power Requirement for NCS(MW)	0.125
MP Steam Requirement (TPH)	3
LP Steam Requirement (TPH)	87
Total Steam Requirement (TPH)	90
Reference Plant:	
Boiler Configuration 87TPH Capacity Boiler; Steam @45kg/cm2 and 415oC; Boiler Efficiency=68%	
Steam Enthalpy = 775.1kcal/kg; Feedwater Enthalpy=105kcal/kg; Bagasse NCV=2272;	
Turbine: 6MW; Turbine Efficiency:90%; Enthalpy drop in Turbine = 113.6kcal/kg;	
Parameters	**Annualised**
POWER	
Net Power output (MW) for HCM Plant	4.3125
Auxillary Consumption of Reference Plant (MW)	1.3125
Total Power output (MW)	5.625
Annual Net electricity generation (MWh)	14490
STEAM	
Steam to TG	47.31514085
Steam through PRDS (HP)	36.9
Steam through PRDS (MP)	3
Desuperheating water addition	2.7
Total LP Steam output (TPH) for HCM Plant	86.91514085
Total MP Steam output (TPH) for HCM Plant	3
Boiler Load	87.21514085
BAGASSE	
NCV	2272
Bagasse Consumption (TPH)	37.82807702
Annual Bagasse Consumption for Crushing Season	127102.3388
Efficiency	0.043152401

Annex 4

MONITORING INFORMATION

Details provided in Section B.7.2

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