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:

BCML Haidergarh Bagasse Co-generation Project (India)

Version: 02; Date: 30/01/2007;

A.2. Description of the project activity:

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

The HCM project activity includes installation of a new high efficiency bagasse-fired co-generation plant which can generate power to the tune of around 20 MW. In addition, BCML installed an additional 3 MW steam turbine and generator set, which generates an average of 2.5 MW of power. With this, total power generation capacity increases to 23 MW with gross power generation of around 22.5 MW. The power generated in the HCM project activity is utilised to meet the power demand of the HCM sugar plant, the auxiliary power consumption of the HCM power plant and the surplus electrical energy is exported to the Uttar Pradesh Power Corporation Limited (UPPCL) grid. The HCM project activity will, therefore, substitute approximately 76.85[1] million kWh of electricity per annum from the Uttar Pradesh Power Corporation Limited (UPPCL) grid. This measure thereby reduces grid-based GHG emissions that result from the country's overwhelming dependency on coal.

BCML's HCM project activity is unique in India due to its installation and use of high efficiency boiler for enhancing the amount of energy produced per unit of bagasse burned, thereby enhancing the potential surplus power generated from its available bagasse. Currently many sugar mills in India inefficiently burn their 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 co-generation 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 that could be far more efficiently burned to generate energy for on-site use and for off-site use through export of its surplus electrical 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 power plants connected to the Northern Regional grid which relies primarily on GHG-emitting conventional fuels like coal and natural gas. After adjusting total electricity export from HCM project activity by a small portion of the bagasse diverted from the paper industry[2], 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 5,84,394 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, 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.

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[1] An annual average of total electricity to be replaced from the UPPCL grid by the HCM project activity over the entire crediting period of 10 years.

[2] 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.

Second, the HCM project activity has contributed to the local job and income creation in a very poor rural area where sugar cane manufacturrers (local farmers) face highly cyclical income flows. It has created steady, higher value jobs and skilled workers at the HCM power plant. 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 co-generation 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 of the mill owners, farmers and power plant operators in high efficiency co-generation 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:

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:

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:

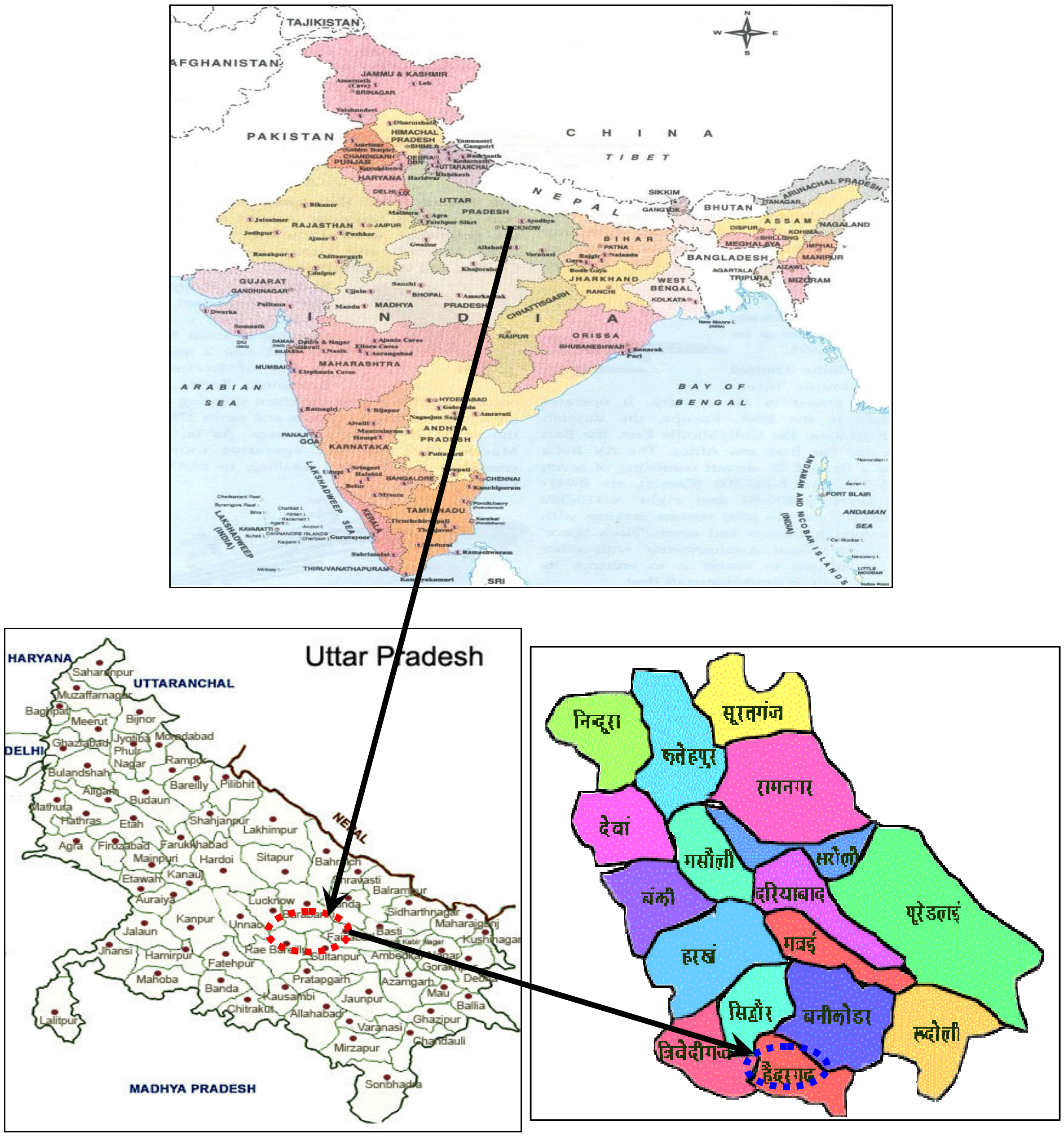
Haidergarh

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

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 co-generation 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 co-generation power plant with a high-pressure steam generator and turbine configuration.

The plant is designed to operate a 120 tonnes 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 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 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 2.5 MW of power in the process of pressure reduction. With this, total power generation capacity of the HCM project activity increases to 23 MW with gross power generation 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 HCM project activity operates for 330 days per annum, which includes around 150 days during the crushing season (November to March), with the balance of about 180 off-season days. After meeting the

steam and power requirements of the co-generation auxiliaries and sugar plant, the 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-generation 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:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Nov, 2003 – Oct, 2004	21159
Nov, 2004 – Oct, 2005	39798
Nov, 2005 – Oct, 2006	57933
Nov, 2006 – Oct, 2007	57841
Nov, 2007 – Oct, 2008	61380
Nov, 2008 – Oct, 2009	65342
Nov, 2009 – Oct, 2010	67700
Nov, 2010 – Oct, 2011	69054
Nov, 2011 – Oct, 2012	69343
Nov, 2012 – Oct, 2013	74844
Total estimated reductions (tonnes of CO_2 e)	**584394**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e/yr)	**58439.4**

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:

The project activity follows the following baseline methodology:

- Version 04 of ACM0006: "Consolidated 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:

ACM0006 Version 04 is applicable to grid-connected and biomass residue fired electricity generation project activities, including co-generation 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 04:

1. The installation of a new biomass residue fired 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. Bagasse generated at sugar plants is used for power generation in the HCM project activity.

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 (small fractions of inert inorganic material like soil or sands may be included). Note that in case of solid biomass residue for all the calculations in this methodology, quantity of biomass residue refers to the *dry* weight of biomass residue.

   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 co-generation 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 residues 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. 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 or mechanical treatment of the biomass residues, 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 fulfills all applicability criteria required by the ACM0006 Version 04 baseline methodology.

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

In accordance with the methodology, the spatial extent of the project boundary for the HCM project activity will encompass:

- The bagasse based co-generation project at the HCM project site which includes all the co-generation plant equipment/ installations and the conveyors for transportation of bagasse residues from the HCM sugar plant and from the stock yard area of the HCM plant and
- All power plants connected physically to the electricity system *i.e.*Northern Regional Electricity Grid where the HCM power plant is also connected.

The following table will elaborate the GHG emission sources and the Green House Gases which are included in/ excluded from the project boundary of the HCM project activity.

<table>
<tr><th colspan="5">Table-B.1: Greenhouse gas emission sources and gases within the project boundary</th></tr>
<tr><th></th><th>Emission Source</th><th>Gas</th><th>Included/ Excluded</th><th>Justification/ Explanation</th></tr>
<tr><td rowspan="9">Baseline</td><td rowspan="3">Grid Electricity Generation</td><td>CO_2</td><td>Included</td><td>Main Emission Source.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>Excluded for simplification. This is conservative.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification. This is conservative.</td></tr>
<tr><td rowspan="3">Heat Generation</td><td>CO_2</td><td>Excluded</td><td>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.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>Excluded for simplification. This is conservative.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification. This is conservative.</td></tr>
<tr><td rowspan="3">Uncontrolled burning or decay of surplus biomass residues</td><td>CO_2</td><td>Excluded</td><td>It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>Emissions from uncontrolled burning or decay of biomass residues are not included to be on the conservative side.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification. This is conservative.</td></tr>
<tr><td rowspan="10">Project Activity</td><td rowspan="3">On site fossil fuel and electricity consumption due to the project activity (stationary or mobile)</td><td>CO_2</td><td>Excluded</td><td>No fossil fuel will be consumed at the project site.
The electricity consumption in the conveyor system (for transportation of bagasse residues) is a part of the auxiliary consumption of the HCM project activity and will be sourced from the HCM power plant where there will be no fossil fuel consumption.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>Excluded for simplification.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification.</td></tr>
<tr><td rowspan="3">Off-site transportation of biomass residues</td><td>CO_2</td><td>Excluded</td><td>The biomass from other units has been excluded as per the guidance of the Meth Panel.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>Excluded for simplification.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification.</td></tr>
<tr><td rowspan="3">Combustion of biomass residues for electricity and/or heat generation</td><td>CO_2</td><td>Excluded</td><td>It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in LULUCF sector.</td></tr>
<tr><td>CH_4</td><td>Excluded</td><td>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.</td></tr>
<tr><td>N_2O</td><td>Excluded</td><td>Excluded for simplification. This emission source is assumed to be small.</td></tr>
<tr><td>Storage of</td><td>CO_2</td><td>Excluded</td><td>It is assumed that CO_2 emissions from surplus biomass</td></tr>
</table>

	biomass residues			residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be small.

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

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 co-generation 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

Secondly, the methodology 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 04. 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 project activity.	The option is installation of a high efficiency bagasse based power system at the HCM plant without the consideration of carbon financing. It is not credible given the barriers to HCM 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	**Yes**

Table-B.2: Potential power generation, heat production, and biomass use baseline options			
Option	**Description**	**Credibility**	**Conc.**
		reference plant (b) partly in power plants in the grid.	
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 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 HCM project activity.	**No**
P4	The generation of power in existing and/or new grid-connected power plants	Same credibility explanation as P2.	**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**
Heat Production			
H1	The HCM project activity not undertaken as a CDM project	The HCM project activity does not generate additional heat with reference to option H2, so option H1 has not	**No**

Table-B.2: Potential power generation, heat production, and biomass use baseline options			
Option	**Description**	**Credibility**	**Conc.**
	activity	been considered separately.	
H2	The HCM project activity (installation of a co-generation power plant), fired with the same type of biomass but with a different efficiency of heat generation (*e.g.* an 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 co-generation 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 co-generation 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 HCM project activity.	**No**
H4	The generation of heat in boilers using the same type of biomass residues	Same credibility explanation as H2.	**No**
H5	The continuation of heat generation in an existing co-generation plant, fired with the same type of biomass residues 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**
H6	The generation of heat in boilers using fossil fuels	Same credibility explanation as H2.	**No**

Table-B.2: Potential power generation, heat production, and biomass use baseline options			
Option	**Description**	**Credibility**	**Conc.**
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 residues are dumped or left to decay under mainly aerobic conditions (for *e.g.*, dumping or decaying of biomass residues on fields)	In absence of the co-generation plant, the bagasse generated at HCM sugar plant would have been burnt in an uncontrolled manner and not dumped. Therefore this is not a credible option.	**No**
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions (for *e.g.* to deep landfills with more than 5 meters)	Same credibility explanation as B1.	**No**
B3	The biomass residues are burned in an uncontrolled manner without utilising it for energy purposes	The bagasse used for electricity generation in the HCM project activity includes bagasse generated at Haidergarh unit[3]. The additional bagasse generated at the Haidergarh Unit with no energy use would be burned in an uncontrolled manner. Therefore B3 is most credible option.	**Yes**
B4	The biomass residues are 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 B4. This is a credible baseline option.	**Yes**
B5	The biomass residues are used for power generation, including co-generation, in other existing or new grid connected power plants	B5 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 HCM project activity is a part of the Greenfield Sugar Project undertaken by BCML at Haidergarh with no existing heat/power generation	**No**

[3] Electricity generated with bagasse from Babhnan Unit of BCML is excluded from consideration as per the guidance by Meth Panel.

Table-B.2: Potential power generation, heat production, and biomass use baseline options			
Option	**Description**	**Credibility**	**Conc.**
		capacity available on-site or nearby the project site, B5 is not a credible option to the project activity.	
B6	The biomass residues are used for heat generation in other existing or new boilers at other sites	Same credibility explanation as B5.	**No**
B7	The biomass residues are 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.* B5, B7 and B8 not applicable)	**No**
B8	The biomass residues are 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 04 methodology, it will be excluded as per the guidance provided by Meth Panel (F-CDM-AM-Rev_Resp_ver 01 – AM_REV_0013).	**No**

After conducting the above separate assessments, BCML 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[4]. Step-3 of the latest approved version of the "Tool for the demonstration 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:

<u>Alternative-1: Co-generation unit to meet the plant's power and steam requirements</u>

In Alternative-1 BCML may implement a bagasse based co-generation 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 co-generation 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 co-generation 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: 4.3125 MW Mill Low Pressure (LP) Steam requirement: 87 TPH Mill Medium Pressure (MP) Steam requirement: 3 TPH Crushing Season : 150 days (approximately) Non-Crushing Season : 180 days (approximately)		
Alternative-1: Co-generation 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 co-generation plant is designed to operate a 87 tonnes per hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 45 kg/cm^2 & 415 ^{0}C and an Extraction cum Condensing (EC) type of turbo-generator set of 6 MW nominal capacity for power output. The reference plant will meet 4.3125 MW power requirement of the HCM Sugar plant and 1.3125 MW power requirement of the co-generation 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 co-generation plant does not export electricity to the UPPCL grid.
Heat (if relevant)	H2	The co-generation 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 steam.
Biomass	B4 and B3	Among the total bagasse generated at Haidergarh sugar plant: - Certain quantum of bagasse is utilised in the reference co-generation plant for generation of steam and power (B4). - The balance quantity of bagasse of Haidergarh sugar plant is burned in an uncontrolled manner without utilizing it for energy purposes (B3).
Conclusion: As per ACM0006/ Version 04, Scenario 4 (comprising of the options P2 and P4, B4, H2) entails the following: *"The project activity involves the installation of a new biomass residue fired power plant at a site where no power was generated prior to the implementation of the project activity. In the absence of the project activity, a new biomass residue fired power plant (in the following referred to as "reference plant") would be installed instead of the project activity at the same site and with the same thermal firing capacity but with a lower electric efficiency as the project plant (e.g. by using a low-pressure boiler instead of a high-pressure boiler). The same type and quantity of biomass residues as in the project plant would be used in the reference plant. Consequently, 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*		

[4] 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 been considered. Alternatives are, therefore, related to technology and circumstances as well as the investor.

the same compared to the reference plant)".

As stated above, the baseline Alternative-1 consists of installation of a new bagasse fired Reference Co-generation Plant with same thermal firing capacity but with lower electric efficiency. The Reference Plant would have utilized the same quantity of bagasse residues for generation of power and because of lower electrical efficiency of the Reference Plant, an equivalent power (*i.e.* incremental power generated in the HCM project activity than that in the Reference Plant) would have been generated in the grid connected power plants. However the heat generated in the Reference Plant would have been similar to that generated in the HCM project activity.

Further, as per ACM0006/ Version 04, Scenario 3 (comprising of the options P4, B3) entails the following:

"The project activity involves the installation of a new biomass residue fired cogeneration plant at a site where no power was generated prior to the implementation of the project activity. The power generated by the project plant is fed into the grid or would in the absence of the project activity be purchased from the grid. The biomass residues would in the absence of the project activity (a) be used for heat generation in boilers at the project site and (b) be dumped or left to decay or burnt in an uncontrolled manner without utilizing it for energy purposes. This may apply, for example, where the quantity of biomass residues that was not needed for heat generation was dumped, left to decay or burnt in an uncontrolled manner prior to the project implementation".

As stated above, the baseline Alternative-1 also consists of burning of surplus bagasse residues (after meeting the bagasse consumptions in the reference co-generation plant) generated in the HCM sugar plant in an uncontrolled manner without utilizing it for energy purposes. Under such circumstance, an equivalent quantum of power (which is generated in the HCM project activity with this surplus bagasse residue) would have been generated in the grid connected power plants.

Therefore Alternative-1 involves a combination of both Scenario-4 and Scenario-3 of ACM0006/ Version 04.

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 co-generation 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 co-generation plant - reference plant of Alternative-1 is determined based on the steam and power requirements of the sugar plant.

Alternative-2: Co-generation 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 co-generation 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 co-generation plant would be operational and the surplus power generation may be exported to UPPCL grid. In Alternative-2 the configuration of the co-generation 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- Co-generation unit to meet the plant's energy requirements with surplus power generation for export to grid [Project Activity] without CDM benefits		
Project Elements	**Baseline Option(s)**	**Greenfield Project Description and Characteristics**
Power	Project Scenario	HCM project activity: The co-generation plant is designed to operate a 120 tonnes per hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 87 kg/cm^2 & 515 ^{0}C and an Extraction cum Condensing (EC) type of turbo-generator set of 20 MW nominal capacity for power output. The STG set of 20 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 2.5 MW of power with the additional steam. With this, total power generation capacity increases to 23 MW with gross power generation of around 22.5 MW. The co-generation plant will meet 4.3125 MW power requirement of the HCM Sugar plant and 1.9825 MW power requirement of the co-generation plant. The co-generation plant will export 16.205 MW of surplus power to the UPPCL grid during the crushing season and 17.875 MW during non-crushing season.
Heat (if relevant)	Project Scenario	The co-generation plant is designed to meet the heat requirements of the Haidergarh Sugar Plant. The co-generation plant will provide 87 TPH L.P. steam and 3 TPH M.P. steam.
Biomass	Project Scenario	The total bagasse generated at Haidergarh sugar plant and the bagasse of other Units (Babhnan) is utilized in the co-generation plant. But bagasse used from Babhnan unit 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. Moreover, 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: Co-generation 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 HCM 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.[5] 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 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 HCM 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.

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 co-generation 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/ MkWh) that exports power to the Uttar Pradesh Power Corporation Limited grid. The surplus power generated from HCM project activity, that is exported to the grid, displaces electricity otherwise generated by grid-connected power plants in the Northern Regional Grid (shown later to have a CO_2 emission factor of 760.43 ton CO_2/ MkWh) 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.

<u>Step-0: Preliminary Screening based on the starting date of the project activity</u>

[5] BCML developed their first project activity– "Balrampur Baggase Co-generation Project", a high pressure co-generation unit using bagasse as fuel in March, 2003 under CDM.

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 of 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 28th 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[6]}. 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.

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

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.[7]

- Alternative-1: Co-generation unit to meet the plant's power and steam requirements
- Alternative-2: Co-generation 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:

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

[7] 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 been considered. Alternatives are, therefore, related to technology and circumstances as well as the investor.

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

At the time of HCM project activity implementation, the potential for baggase based co-generation in Uttar Pradesh was 1000 MW out of which only 46.5 MW was commissioned till 31st December 2002.[8] 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 co-generation 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 viable for mills to install high pressure co-generation systems that maximize power output per ton of bagasse burned to generate excess (surplus) power for sale to the retail electricity market.

Most sugarcane manufacturers also do not have the stable cash flows to obtain private sector financing for investing in high efficiency co-generation 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,

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[8] Source: http://mnes.nic.in/business%20oppertunity/pgtbp.htm

private power electricity price schedules, *etc*,) that provide enforceable product price and purchase guarantees to determine the minimum cash flow scenario(s). BCML too faced a lot of financial hurdles while setting up the HCM project activity due to its high upfront investment, unconventional nature (as discussed in 'Technological Barriers' given below) and risks associated with export of surplus power. Therefore the HCM project activity was strongly discouraged by most of the Board Members. In absence of the CDM revenue consideration, BCML would have proceeded with Alternative-1 (which is a part of their Growth Plan project of setting up a Greenfield Sugar Plant at Haidergarh) by securing financing majorly through internal accruals and through other sources. 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 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 new 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 HCM 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 co-generation 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, at the time of HCM project activity implementation, the potential for baggase based co-generation in Uttar Pradesh was 1000 MW out of which only 46.5 MW was commissioned till 31st December 2002.[9] Success of the CDM project activity 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 recruiting trained engineers, 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 proponent has 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 and distribution.

- Institutional Barriers: HCM project activity had to sign a Power Purchase Agreement (PPA) with the Uttar Pradesh Power Corporation Limited (UPPCL) to facilitate the sale of its surplus bagasse-based electricity to UPPCL. To obtain their revenues, the HCM project activity depends on payment from UPPCL against the sale of electricity to the grid, proven by standard metering.

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[9] Source: http://mnes.nic.in/business%20oppertunity/pgtbp.htm

However it was known during the early project years that the liquidity and financial conditions of state electricity boards in India were not very healthy[10]. BCML's management realized the institutional risks that there could be problems with the HCM project activity's cash flows due to uneven payments from UPPCL. BCML, however, undertook this risk and faced this barrier on which they have limited or no control. This risky payment situation makes CDM-based carbon funds even more critical for the 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 co-generation 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 HCM project activity to reduce grid-based greenhouse gas emissions. 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: Common Practice Analysis

The project proponent is further required to conduct the common practice analysis as a credibility check to complement the barrier analysis (Step-3). The project proponent is required to identify and discuss the existing common practice through the following sub-steps:

Sub-step 4a: Analyze other activities similar to the proposed project activity
Sub-step 4b: Discuss any similar options that are occurring

From '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 Alternative-2 (high efficiency/surplus power generation) faces barriers, which

[10] Reference: Official website of Uttar Pradesh Electricity Regulatory Commisions, www.uperc.org

would prevent BCML from implementing the HCM project activity as elaborated in 'Step-3: Barrier Analysis'.

At the time of HCM project activity implementation, the potential for baggase based co-generation in Uttar Pradesh was 1000 MW out of which only 46.5 MW was commissioned till 31st December 2002.[11] This proves that bagasse based co-generation was not a common practice in Uttar Pradesh at the time of inception of the HCM project activity. Moreover most of the Indian sugar manufacturing units (as well as the sugar manufacturing units in Uttar Pradesh), equipped with a co-generation system, 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 (*i.e.* Alternative-1). High pressure (87 kg/cm^2) co-generation system, similar to that of HCM project activity, is not a widespread proposition for the sugar-manufacturing units in similar socio-economic environment of Uttar Pradesh State. The same can be established as given below:

Table-B.5: Data on co-generation practices adopted by Uttar Pradesh sugar mills	
Description	**Mills (Number)**
Number of sugar mills in Uttar Pradesh	114[12]
Co-generation unit to meet the plant's energy requirements with surplus power generation	5[13]

The above information clearly depicts that co-generation unit with surplus power generation is not a widespread proposition for sugar plants in Uttar Pradesh. Only 4.4% of the sugar plants in Uttar Pradesh have adopted for high pressure (87 kg/cm^2) co-generation system which enables surplus power generation from the co-generation unit. At the time of HCM project activity implementation, it was the second sugar manufacturing unit in Uttar Pradesh with high pressure co-generation system, the first one being the BCML project activity at Balrampur[14]. Furthermore all these five plants have implemented the high pressure co-generation system with CDM revenue under consideration. Therefore in the absence of these CDM project activities, there would be no bagasse-based co-generation unit, which would meet the

[11] Source: http://mnes.nic.in/business%20oppertunity/pgtbp.htm

[12] Source: http://www.upcane.org/sector_chini.htm

[13] The five plants are: (1) Balrampur Chini Mills Limited of BCML at Balrampur, (2) Haidergarh Chini Mills of BCML at Haidergarh, (3) Triveni Engineering & Industries Limited at Deoband, (4) Dalmia Sugars Limited at Shahjahanpur and (5) Mawana Sugars Limited at Meerut.

plant's energy requirements and generate surplus power to export to the grid. This shows that there is quite a poor penetration of the practice of surplus power generation through high-efficiency/ high-pressure co-generation technology in the sugar manufacturing units of Uttar Pradesh.

Step-5: Impact of CDM registration

The potential benefits and incentives realised due to approval and registration of the HCM 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 HCM project activity.

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 HCM project activity would result in and its associated carbon financing the HCM project activity would receive through sale of CERs under the Clean Development Mechanism .

It is ascertained that the HCM 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.

[14] Source: 'Part-I: Renewable Energy Technologies: Investment Opportunities- Biomass Energy and Co-generation' taken from "Renewable Energy in India-Business Opportunities/ February 2004' available at http://mnes.nic.in/business%20oppertunity/index.htm

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:

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 04 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 for the HCM project activity. The supporting data values used to determine the 'CO_2 emission factors' and other information are provided in 'Annex-3: Baseline Information' to the PDD.

Baseline

The baseline scenario for the HCM project activity was determined above to be "Alternative-1: Co-generation 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 activity.

The equations, supporting data, and results for determining the GHG emissions and emission reductions by the HCM project activity are provided below, following the guidance of ACM0006 Version 04.

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 power 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,

$ER_{heat,y}$ are the emission reductions due to displacement of heat 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,

$BE_{biomass,y}$ 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 as 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 emission due to natural decay or burning of anthropogenic sources; and,
- The project (methane) emission 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 residues to the project site (PET_y) and CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$):

$$PE_y = PET_y + PEFF_y$$

where:

PET_y are the CO_2 emissions during the year y due to transport of the biomass residues to the project plant in tons of CO_2/ year,

$PEFF_y$ are the CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity in tons of CO_2/ year,

The emission source - CH_4 emissions from combustion of biomass residues ($PE_{Biomass,CH4,y}$) 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 residues 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 04:

$$PET_y = N_y \otimes AVD_y \otimes EF_{km,CO2,y}$$

Or

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \otimes AVD_y \otimes EF_{km,CO2,y}$$

where:

N_y is the number of truck trips during the period y.

AVD_y is the average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year y in kilometers (km),

$EF_{km,CO2}$ is the average CO_2 emission factor for the trucks measured during the year y in t CO_2/km, and

BF_{ky} is the quantity of biomass residue type k 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 during the year y 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 (*i.e.* $PET_y = 0$).

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:

$$PEFF_y = \sum_i (FF_{projectplant,i,y} + FF_{projectsite,i,y}) \otimes NCV_i \otimes COEF_i$$

where:

$FF_{project\ plant,i,y}$ Quantity of fossil fuel type *i* combusted in the biomass residue fired power plant during the year y (in mass or volume unit),

$FF_{project\ site.i,y}$ Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year y (mass or volume unit per year)

NCV_i is the Net calorific Value of the fosil fuel *i* (GJ/ mass or volume unit)

$COEF_i$ is the CO_2 emission factor of the fuel type *i* (tCO_2/GJ)

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. Among the total bagasse generated at Haidergarh sugar plant,

- certain quantum of bagasse would have been utilised in the reference co-generation plant for generation of steam and power (B4) in absence of the HCM project activity and
- the balance quantity of bagasse of Haidergarh sugar plant would have been burned in an uncontrolled manner without utilizing it for energy purposes (B3) in absence of the HCM project activity.

As per the methodology ACM0006/ Version 04,

"Where the most likely baseline scenario is the use of the biomass residues for energy generation, the diversion of biomass residues to the project activity is already considered in the calculation of baseline

reductions. In this case, leakage effects do not need to be addressed. Where the most likely baseline scenario is that the biomass residues are dumped or left to decay or burnt in an uncontrolled manner without utilizing it for energy purposes, project participants shall demonstrate that the use of the biomass residues does not result in increased fossil fuel consumption elsewhere. For this purpose, project participants shall assess as part of the monitoring the supply situation for the types of biomass residues used in the project plant.

Therefore in accordance with the methodology, the project proponent is required to establish that the portion of the bagasse quantity generated in the Haidergarh sugar plant, which otherwise would have been burnt in an uncontrolled manner without utilizing for energy purposes in absence of the HCM project activity (*i.e.* bagasse quantity corresponding to B3), does not result in increased fossil fuel consumption elsewhere. Since the HCM sugar plant is a greenfield power project, the bagasse generated at the HCM sugar plant was not available for use to other users. Therefore there is no diversion of bagasse with the implementation of the HCM project activity which may result in an increase in emissions from fossil fuel combustion at other sources with respect to the B3 quantity of bagasse generated in the HCM sugar plant. Furthermore in the state of Uttar Pradesh, bagasse is available in abundance. At the time of HCM project activity implementation, the potential for baggase based co-generation in Uttar Pradesh was 1000 MW out of which only 46.5 MW was commissioned till 31st December 2002[15]. Over the last three years, the capacity of bagasse based co-generation in Uttar Pradesh has increased only upto 73MW (as on 31st March 2005)[16]. Therefore only 7.3% of the total bagasse based co-generation potential has been harnessed in Uttar Pradesh with a substantial quantum of bagasse being unutilised.

Due to the surplus availability of bagasse in Uttar Pradesh as explained above, it can be stated that there is no energy or non-energy sources which would utilize the surplus bagasse (*i.e.* bagasse quantity corresponding to B3 generated in the HCM sugar plant) and the same would have been combusted in an uncontrolled manner in absence of the HCM project activity. Therefore it may be concluded that the usage of the surplus bagasse in the HCM project activity would not result in increased fossil fuel consumption elsewhere and hence there will be no emissions associated to leakage ($L_y = 0$).

However abundant biomass availability will be demonstrated throughout the crediting period as per L2 option of the baseline methodology through a third party study conducted on

- the availability of bagasse within 200 km of HCM sugar plant (hereafter referred to as 'region') and
- the usage of bagasse in the region.

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[15] Source: http://mnes.nic.in/business%20oppertunity/pgtbp.htm

[16] Source: http://www.techno-preneur.net/New-technologies/Energy/bagasse.htm

Under circumstances wherein the study revels that for a particular year within the proposed crediting period of the HCM project activity, the bagasse quantity available in the region is not more than 25% of the bagasse utilised (including the bagasse utilised in the HCM project plant) in the region, the abundant bagasse availability is not demonstrated as per L2 option of the baseline methodology. Under such circumstance, leakage effect for the particular year shall be accounted for in the computation of emission reduction resulting from the HCM project activity.

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 HCM project activity in the Northern Regional grid, summed over the crediting period. The equation is as follows:

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

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 HCM 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 HCM project activity during the year y in tons CO_2/MWh.

Step-I: 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:

The grid emission factor, $EF_{grid,y}$, 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/ Version 06).

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 [*i.e.* average of Operating Margin (determined based on average of 3-years' *i.e.* 2002-2003, 2003-2004 and 2004-2005 Simple Operating Margin) and Build Margin (determined for the year 2004-2005)] by Central Electricity Authority of Government of India (Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006) following the guidelines provided in ACM0002/ Version 06 and found to be 760.43 tCO_2/MkWh. Please refer to 'Annex-3: Baseline Information' for further details on the computation of Operating Margin emission factor, Build Margin emission factor and Combined Margin emission factor for Northern Regional Grid.

Step-II: 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 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.

Step-II.(a): Determination of EG_y resulting from increased energy efficiency of HCM project plant[17] than that of the reference plant (as per Scenario 4 of ACM0006/ Version 04)

EG_{y1} : the net quantity of increased electricity generation as a result of the HCM 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 04. As per Scenario 4, the biomass residues, used in the HCM project plant, would have been used in the reference plant and the power generated by the HCM project plant would in absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the HCM project plant than in the reference plant due to improved efficiency – (b) partly in power plants in the grid. The heat generated by the HCM 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).

Therefore for Scenario 4, EG_{y1} corresponds to the difference between the electricity generated in the HCM project plant using the same quantity of bagasse residues that would have been fired in the reference plant and the quantity of electricity that would have been generated by the reference plant:

[17] HCM project plant refers to the co-generation plant of HCM.

$$EG_{y1} = EG_{projectplant,y1} - \varepsilon_{el,otherplant(s)} \otimes \left(\frac{1}{3.6}\right) \otimes \sum_{k} BF_{k,y1} \otimes NCV_k$$

where:

EG_{y1} is the net quantity of increased electricity generation as a result of the improved energy efficiency of the HCM project activity (incremental to the generation in the reference plant) during the year y in MWh,

$EG_{project\ plant,y1}$ is the net quantity of electricity generated in the HCM project plant during the year y using the same quantity of bagasse residues fired in the reference plant, expressed in MWh; The parameter is determined based on the 'net electricity generated at HCM project plant during the year y', 'total quantum of bagasse residues consumed in the HCM project plant during the year y' and 'the quantum of bagasse residues which would have been combusted in the reference plant in absence of the HCM project activity during the year y'.

$\varepsilon_{el,other\ plant(s)}$ is the average net energy efficiency of electricity generation in the reference plant that would use the bagasse residues fired in the HCM project plant in the absence of the HCM project activity, expressed in $MWh_{el}/MWh_{biomass}$

$BF_{k,y1}$ is the quantity of bagasse residues of type k combusted in the reference plant during the year y in absence of the HCM project activity, expressed in tonnes. This will be determined based on the total electricity that would need to be generated in the reference plant in the year y, the average net energy efficiency of electricity generation in the reference plant and the calorific value of bagasse residues.

NCV_k is the net calorific value of the bagasse residue of type k in GJ/ton of bagasse.

Step-II.(b): Determination of EG_y resulting from usage of bagasse residues in HCM project plant that otherwise would have been burned in an uncontrolled manner (as per Scenario 3 of ACM0006/ Version 04)

EG_{y2} : the net quantity of increased electricity generation as a result of the HCM project activity during the year y, for using bagasse residues that would otherwise be burned in an uncontrolled manner, is determined as per Scenario 3 of the Table 1 of the ACM0006/ Version 04 wherein the biomass residues 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.

Therefore for Scenario 3, EG_{y2} corresponds to the net quantity of electricity generation in the HCM project plant using the bagasse residues which otherwise would have been burned in an uncontrolled manner in absence of the HCM project activity and is calculated as:

$$EG_{y2} = EG_{projectplant,y2}$$

where:

EG_{y2} is the net quantity of increased electricity generation as a result of the HCM project activity during the year y, for using bagasse residues that would otherwise be burned in an uncontrolled manner in MWh,

$EG_{project\ plant,y2}$ is the net quantity of electricity generated in the HCM project plant during the year y using bagasse residues that would otherwise be burned in an uncontrolled manner, expressed in MWh. The same will be determined based on the net quantity of electricity generated in the HCM project plant ($EG_{project\ plant,y}$), total consumption of bagasse residues of type k in the HCM project plant and the quantity of bagasse residues of type k which otherwise would have been burned in an uncontrolled manner ($BF_{k,y2}$) in absence of the HCM project activity during the year y. $BF_{k,y2}$ will be determined as the difference between the total bagasse residues of type k generated in the HCM sugar plant during the year y and the bagasse residues of type k combusted in the reference plant in absence of the HCM project activity in the year y (*i.e.* $BF_{k,y1}$).

EG_y *i.e.* the net quantity of increased electricity generation as a result of the HCM project activity (incremental to baseline generation) during the year *y* will be determined as a sum of $EG_{y,1}$ and $EG_{y,2}$.

Transmission and Distribution Losses-As per the guidance in the baseline methodology, the transmission and distribution losses in the electricity grid are not influenced significantly by the HCM 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 HCM project activity but is required to demonstrate that emissions do not arise from combustion of more bagasse residues.

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,
- Account for any increases in CO_2 emissions.

The thermal efficiency in the HCM project plant is larger than the thermal efficiency of the reference plant. Further this increased level of heat generation as a result of the HCM 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 residue;

(c) Co-firing fossil fuels in the project plant, *e.g.* in cases where the supply of biomass residues 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 residue 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/ Version 04 given below:

$$PEFF_y = \sum_i \left(FF_{projectplant,i,y} + FF_{projectsite,i,y}\right) \otimes NCV_i \otimes COEF_i$$

where:

$FF_{project\ plant.i,y}$	Quantity of fossil fuel type *i* combusted in the biomass residue fired power plant during the year y (mass or volume unit per year)
$FF_{project\ site.i,y}$	Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year y (mass or volume unit per year)
NCV_i	Net calorific value of fossil fuel type *i* (GJ/ mass or volume unit)
$COEF_i$	CO_2 emission factor for fossil fuel type *i* (tCO_2/GJ)

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 HCM project activity additional bagasse residue 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 residues 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:

The Combined Margin emission factor, which is the weighted average of the Operating Margin emission factor and the Build Margin emission factor, for Northern regional grid is calculated as per ACM0002/ Version 06 by Central Electricity Authority of Government of India. The Operating margin emission factor ($EF_{OM,y}$), Build Margin emission factor ($EF_{BM,y}$) and the Combined Margin emission factor ($EF_{electricity,y}$) for Northern Regional Grid are available at the start of the crediting period, as given below, and will remain fixed for the entire crediting period of 10 years:

Data / Parameter:	$EF_{electricity,y}$
Data unit:	tCO_2/ MWh
Description:	CO_2 emission factor of the grid
Source of data used:	Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006, as published by Central Electricity Authority of Government of India
Value applied:	0.76043
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from Central Electricity Authority of Government of India has been used. The same is calculated as a weighted sum of Operating margin emission factor and Build Margin emission factor following the guidelines of ACM0002/ Version 06 methodology. Recording frequency – Once at the start of crediting period.
Any comment:	Please refer to 'Annex-3: Baseline Information' of PDD for details.

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/ MWh
Description:	CO_2 Operating Margin emission factor of the grid
Source of data used:	Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006, as published by Central Electricity Authority of Government of India
Value applied:	0.98733
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from Central Electricity Authority of Government of India has been used. The same is calculated as an average of 3-years' (*i.e.* 2002-2003, 2003-2004 and 2004-2005) Simple Operating Margin emission factor following the guidelines of ACM0002/ Version 06 methodology. Recording frequency – Once at the start of crediting period.
Any comment:	Please refer to 'Annex-3: Baseline Information' of PDD for details.

Data / Parameter:	$EF_{BM,y}$

Data unit:	tCO_2/ MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data used:	Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006, as published by Central Electricity Authority of Government of India
Value applied:	0.53353
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from Central Electricity Authority of Government of India has been used. The same is calculated for the year 2004-2005 following the guidelines of ACM0002/ Version 06 methodology. Recording frequency – Once at the start of crediting period.
Any comment:	Please refer to 'Annex-3: Baseline Information' of PDD for details.

The average net energy efficiency of electricity generation in the reference plant is determined at the start of the crediting period and it will remain fixed for the entire crediting period.

Data / Parameter:	$\varepsilon_{el,other\ plant(s)}$
Data unit:	$MWh_{el}/MWh_{biomass}$
Description:	Average net energy efficiency of electricity generation in the reference plant
Source of data used:	Calculated from the consumption of biomass and electricity in the reference plant.
Value applied:	0.046
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: Baseline Information' for further details.

B.6.3 Calculation of emission reductions:

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,

$ER_{heat,y}$ are the emission reductions due to displacement of heat 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,

$BE_{biomass,y}$ 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.8: Data inputs for emission reduction calculations		
Parameter	**Value**	**Comments**
$ER_{heat, y}$	0	The increased level of heat generation as a result of the HCM 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
$ER_{electricity,y}$	Please refer to 'Annex-3: Baseline Information' for further details.	Calculated as combined emission due to electricity generation which is attributed to: i) EG_{y1} *i.e.* the net quantity of increased electricity generation as a result of the HCM project activity (incremental to the generation in the reference plant) during the year y and ii) EG_{y2} *i.e.* the net quantity of increased electricity generation as a result of the HCM project activity during the year y, for using bagasse residues that would otherwise be burned in an uncontrolled manner
$BE_{biomass, y}$	0	Excluded-Please refer to Table B.1 of Section B.3 of the PDD.
PE_y	0	Refer to Section B.6.1 of the PDD.
L_y	0	Refer to Section B.6.1 of the PDD.

B.6.4 Summary of the estimated emission reductions:

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)
Nov, 2003- Oct, 2004	0	21159	0	21159
Nov, 2004- Oct, 2005	0	39798	0	39798
Nov, 2005- Oct, 2006	0	57933	0	57933
Nov, 2006- Oct, 2007	0	57841	0	57841
Nov, 2007- Oct, 2008	0	61380	0	61380
Nov, 2008- Oct, 2009	0	65342	0	65342
Nov, 2009- Oct, 2010	0	67700	0	67700
Nov, 2010- Oct, 2011	0	69054	0	69054
Nov 2011,- Oct, 2012	0	69343	0	69343
Nov, 2012- Oct, 2013	0	74844	0	74844
Total (tonnes of CO_2e)	**0**	**584394**	**0**	**584394**

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

The HCM project activity follows the following baseline methodology:

- Version 04 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 methodology:

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

B.7.1 Data and parameters monitored:

Parameters to be monitored for the computation of Baseline Emissions

Data / Parameter:	$EG_{project\ plant,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated in the HCM project plant 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	Please refer to 'Annex-3: Baseline Information' for further details.
Description of measurement methods and procedures to be applied:	The HCM 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 and net 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 and net 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:	$EG_{projectplant,y1}$
Data unit:	MWh
Description:	Net quantity of electricity generated in the HCM project plant during the year y using the same quantity of bagasse residues fired in the reference plant *i.e.* net electricity generation associated with improved efficiency of HCM project plant.
Source of data to be used:	Plant Records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to 'Annex-3: Baseline Information' for further details.
Description of measurement methods and procedures to be applied:	Calculated for Scenario 4 based on - net electricity generated at HCM project plant during the year y - total quantum of bagasse residues consumed in the HCM project plant during the year y and - total quantum of bagasse residues which would have been combusted in the reference plant in absence of the HCM project activity during the year y
QA/QC procedures to be applied:	The parameter will be determined based on the three parameters as mentioned above. The reliability of all these parameters is high as explained in the respective sections. This justifies the lower uncertainty level of the parameter under consideration. Therefore no QA/QC is required for the parameter under consideration.
Any comment:	-

Data / Parameter:	$EG_{projectplant,y2}$
Data unit:	MWh
Description:	Net quantity of electricity generated in the HCM project plant during the year y using bagasse residues that would otherwise be burned in an uncontrolled manner.
Source of data to be used:	Plant Records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to 'Annex-3: Baseline Information' for further details.
Description of measurement methods and procedures to be applied:	Calculated for Scenario 3 based on - net electricity generated at HCM project plant during the year y - total quantum of bagasse residues consumed in the HCM project plant during the year y and - total quantum of bagasse residues which otherwise would have been burned in an uncontrolled manner in absence of the HCM project activity
QA/QC procedures to be applied:	The parameter will be determined based on the three parameters as mentioned above. The reliability of all these parameters is high as explained in the respective sections. This justifies the lower uncertainty level of the parameter under consideration. Therefore no QA/QC is required for the parameter under consideration.
Any comment:	-

Data / Parameter:	$BF_{k,y}$
Data unit:	tonnes
Description:	Quantity of bagasse residue of type k generated in the HCM sugar plant during the year y
Source of data to be used:	Final Manufacturing Report as published in Form R.T.8(C).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to 'Annex-3: Baseline Information' for further details.
Description of measurement methods and procedures to be applied:	The quantity of bagasse generated in the HCM sugar plant will be determined from the measured quantity of cane crushed and the percentage of bagasse in cane.
QA/QC procedures to	Yes. The Final Manufacturing Report of HCM plant will be submitted to the

be applied:	Central Excise Department- Lucknow Division and the same will be compiled by them in the Form R.T.8(C). Data taken from a document published by Central Excise Department of Government of India justifies lower uncertainty level of the parameter. However the same can also be cross-verified by conducting an annual energy balance for the sugar manufacturing unit of HCM plant.
Any comment	In case of consumption of any other types of biomass other than bagasse residue by the HCM project plant, consumption of the other biomass type will also be monitored.

Data / Parameter:	$BF_{k,y1}$
Data unit:	Tonnes
Description:	Quantity of bagasse residues of type k which otherwise would have been combusted in the reference plant in absence of the HCM project activity 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	Please refer to $BF_{k,y1}$ quantity as provided in 'Annex-3: Baseline Information' of the PDD.
Description of measurement methods and procedures to be applied:	The parameter will be calculated based on - Total electricity which otherwise would have been generated in the reference plant in absence of the HCM project activity during the crushing season[18] - Average net energy efficiency of electricity generation in the reference plant and - Net Calorific Value of the bagasse residue
QA/QC procedures to be applied:	The reliability of the net electricity generated in the HCM project plant during the crushing season will always be ensured by the project proponent as described above. Average net energy efficiency of electricity generation in the reference plant is determined based on a similar unit of BCML at the start of the crediting period. The same can always be cross-verified. Furthermore the reliability of the data on net calorific value of the bagasse residue will also be ensured by the project proponent as explained below. This justifies lower level of uncertainty of the parameter under consideration and hence no QA/QC is required for the same.
Any comment	-

[18] Only during the crushing season the reference plant will be operative. The small quantum of electricity requirement of the reference plant during the non-crushing season, would be obtained from the grid.

Data / Parameter:	$BF_{k,y2}$
Data unit:	Tonnes
Description:	Quantity of bagasse residues of type k which otherwise would have been burned in an uncontrolled manner in absence of the HCM project activity 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	Please refer to $BF_{k,y2}$ quantity as provided in 'Annex-3: Baseline Information' of the PDD.
Description of measurement methods and procedures to be applied:	The parameter will be calculated as a difference between - Quantity of bagasse residue of type k generated in the HCM sugar plant during the year y (*i.e.* $BF_{k,y}$) and - Quantity of bagasse residues of type k which otherwise would have been combusted in the reference plant in absence of the HCM project activity during the year y (*i.e.* $BF_{k,y1}$)
QA/QC procedures to be applied:	The reliability of both the above-mentioned parameters is high as explained above in relevant sections. This justifies lower level of uncertainty of the parameter under consideration and hence no QA/QC is required for the same.
Any comment	-

Data / Parameter:	NCV_k
Data unit:	GJ/t
Description:	Net calorific value of bagasse residue of type k combusted in the HCM project plant.
Source of data to be used:	Plant Records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to 'Annex-3: Baseline Information' for details.
Description of measurement methods and procedures to be applied:	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	In case of consumption of any other types of biomass other than bagasse residue by the HCM project plant, net calorific value of the other biomass type will also be monitored.

Parameters to be monitored for the computation of Project Emissions

Data / Parameter:	$FF_{project\ plant,i,y}$
Data unit:	Mass or volume unit per year
Description:	Quantity of fossil fuel type *i* combusted in the biomass residue fired power plant during the year y
Source of data to be used:	On-site measurement/ Plant Log Book
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:	The parameter will be determined continuously with the help of a mass flow meter or a volume flow meter depending on the type of the fuel used. The meter will be calibrated at regular intervals to ensure accuracy of measurement.
QA/QC procedures to be applied:	The reliability of the parameter will be ensured through proper calibration of the monitoring equipment. Furthermore the monitored parameter can be cross-checked with an annual energy balance based on the purchased quantity and change of stock.
Any comment	This should include fossil fuels co-fired in the HCM project plant but not any other fuel consumption at the project site that is attributable to the HCM project activity.

Data / Parameter:	$FF_{project\ site.i,y}$
Data unit:	Mass or volume unit per year
Description:	Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year y
Source of data to be used:	On-site measurement/ Plant Log Book
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:	The parameter will be determined continuously with the help of a mass flow meter or a volume flow meter depending on the type of the fuel used. The meter will be calibrated at regular intervals to ensure accuracy of measurement.
QA/QC procedures to be applied:	The reliability of the parameter will be ensured through proper calibration of the monitoring equipment. Furthermore the monitored parameter can be cross-checked with an annual energy balance based on the purchased quantity and change of stock.

Any comment	This should not include fossil fuels co-fired in the HCM project plant but any other fuel consumption at the project site that is attributable to the HCM project activity.

Data / Parameter:	NCV_i
Data unit:	GJ/ mass or volume unit
Description:	Net calorific Value of the fossil fuel type *i*
Source of data to be used:	Plant Records/ Local or National data. Where such data is not available, IPCC default net calorific values (country-specific, if available) will be used if they are deemed to reasonably represent local circumstances.
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:	Measurements shall be carried out at reputed laboratories and according to relevant international standards. In case of standard values from local or national data sources, the reliability will be ensured by the project proponent.
QA/QC procedures to be applied:	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	Conservative approach will be adopted to determine the parameter.

Data / Parameter:	$COEF_i$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the fossil fuel type *i*
Source of data to be used:	Plant Records/ Local or National data/ IPCC default value.
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:	Measurements shall be carried out at reputed laboratories and according to relevant international standards. In case of standard values from local or national data sources, the reliability will be ensured by the project proponent.
QA/QC procedures to be applied:	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	Conservative approach will be adopted to determine the parameter.

Parameters to be monitored for the computation of Leakage Emissions

Data / Parameter:	$BF_{i,y}$
Data unit:	tonnes
Description:	Quantity of bagasse residue of 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:	Third Party Data Analysis.
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:	The study on availability of bagasse will be conducted within 200 km of HCM sugar plant by a third party on an annual basis.
QA/QC procedures to be applied:	The parameter will be determined from the study report on availability of bagasse conducted by a third party which will ensure the reliability of the parameter. Therefore no QA/QC is required for the parameter under consideration.
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/ Version 06.
Source of data to be used:	Local or National Reports/ 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:	The parameter will be taken from authentic local or national reports or from IPCC default values. Therefore no QA/QC is required for the parameter under consideration.
Any comment	-

Data / Parameter:	$BF_{y,surplus}$
Data unit:	tonnes
Description:	Quantity of biomass residue of type k that is available in surplus in the region/country.
Source of data to be used:	Official data (statistics, relevant, publications, *etc.*) or an own survey will be conducted.
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:	The parameter will be obtained from measured values or calculated values on different types of biomass, available in surplus, in the region/ country, as published annually in official statistics or in own survey reports.
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:

Please refer to 'Annex-4: Monitoring Information'.

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)

Parameter	**Details**
Date of completing the final draft of this baseline selection and monitoring plan	04/09/2006
Name of person/ entity determining the baseline and establishing the monitoring plan	Haidergarh Chini Mills, a unit of Balrampur Chini Mills Limited
Note: The contact information for the project proponent, Haidergarh Chini Mills, is provided in Annex-1 of this Project Design Document.	

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:

28/10/2002.

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

20 y 0 m

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:

01/11/2003

C.2.2.2. Length:

10 y 0 m

SECTION D. Environmental impacts

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. <u>Environment Management Plan</u> – Not Applicable
<u>Impact on Terrestrial Ecology</u> 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.

Environment Management Plan

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:

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 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

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

The HCM project activity received BCML management approval on 28th October 2002. 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)
- Consultants
- Equipment Suppliers
- Uttar Pradesh Power Corporation Limited (UPPCL)
- Uttar Pradesh Electricity Regulatory Commission (UPERC)
- Uttar Pradesh Pollution Control Board (UPPCB)

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.

The process of stakeholder consultation was initiated by BCML by verbally communicating and sharing salient information of the HCM project activity with the identified stakeholders. BCML representatives also met the listed stakeholders 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:

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 received 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 are required to supply raw material *i.e.* sugar cane for sugar mills (with bagasse as by product) and biomass (if required) for the co-generation 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.

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) has 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 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 Project 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:	Director cum Chief Financial Officer
Salutation:	Mr.
Last Name:	Shah
Middle Name:	-
First Name:	Kishor
Department:	-
Mobile:	+91 9830030307
Direct FAX:	+91 33 2287 3083
Direct tel:	+91 33 2289 1637
Personal E-Mail:	kshah@chini.com

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 HCM project activity exports electricity to UPPCL, Uttar Pradesh which is a part of the Northern Region Grid. Therefore as per the guidance provided in ACM0002, the Northern Region Grid has been considered as the grid where an equivalent power generation will be replaced with the implementation of the HCM project activity.

The Northern Regional Grid emission factor, $EF_{grid,y}$ (= $EF_{electricity,y}$), is calculated as a combined margin (CM), following the guidance provided in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002/ Version 06) as a weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) as described below:

Step-I: Calculation of CO_2 Operating Margin emission factor of Northern Regional Grid ($EF_{OM,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Operating Margin emission factor of Northern Regional Grid as an average of the 3-years' (*i.e.* 2002-2003, 2003-2004 and 2004-2005) Simple Operating Margin emission factor of the Northern Regional Grid. The Simple Operating Margin emission factors are calculated following the guidance of ACM0002/ Version 06. The following table gives the CO_2 Operating Margin emission factor of Northern Regional Grid as provided by CEA in 'Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006'.

Computation of Operating Margin Emission Factor for Northern Regional Grid					
Parameters	Unit	2002-2003	2003-2004	2004-2005	Remarks/ Source
Simple Operating Margin Emission Factor, $EF_{OM,Simple,y}$	tCO_2/MWh	999.35	986.94	975.68	Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006 available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Operating Marging Emission Factor, $EF_{OM,y}$	tCO_2/MWh	987.33			3-years' average

Step-II: Calculation of CO_2 Build Margin emission factor of Northern Regional Grid ($EF_{BM,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Build Margin emission factor of Northern Regional Grid for the year 2004-2005 following the guidance of ACM0002/ Version 06. The following table gives the CO_2 Build Margin emission factor of Northern Regional Grid as provided by CEA in 'Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006'.

Computation of Build Margin Emission Factor for Northern Regional Grid			
Parameters	Unit	2004-2005	Remarks/ Source
Build Margin Emission Factor, $EF_{BM,y}$	tCO_2/MkWh	533.53	Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006 available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step-III: Calculation of CO_2 emission factor of Northern Regional Grid ($EF_{electricity,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 emission factor of Northern Regional Grid following the guidance of ACM0002/ Version 06 as a weighted average of the Operating Margin emission factor and Build Margin emission factor of the Northern Regional Grid. The following table gives the CO_2 emission factor of the Northern Regional Grid as provided by CEA in 'Baseline Carbon Dioxide Emission Database/ Version 1.1 dated December 2006'.

Data used for CO_2 Emission Factor of Northern regional Grid		
Parameters	**Values (ton of CO_2/MkWh)**	**Remarks**
Operating Margin Emission Factor, $EF_{OM,y}$	987.33	Please refer to Step-I above.
Build Margin Emision Factor, $EF_{BM,y}$	533.53	Please refer to Step-II above.
CO_2 Emission Factor of Northern Regional Grid, $EF_{electricity,y}$	**760.43**	Calculated

The CO_2 Emission Factor of Northern Regional Grid has been calculated at the start of the crediting period and will remain fixed for the entire crediting period of 10 years.

Computation of Average net energy efficiency of electricity generation in the Reference Plant		
Parameters	**Unit**	**Annualised Value**

4500 TCD HCM Sugar Plant		
Crushing Season	days	150
Reference Plant - 4500 TCD		
Boiler Specification: 87 TPH Capacity Boiler; Steam @ 45 kg/cm^2 and 415^{o}C; Feed Water Temperature= 105^{0}C; Boiler Efficiency=68%,		
Turbine Specification: 6 MW Turbine; Steam at Turbine inlet @ 45 kg/cm^2 and 415^{o}C; Turbine Efficiency: 90%;		
Fuel- Bagasse: Gross Calorific Value of Bagasse = 2272 kCal/kg;		
Enthalpy of Boiler Feed Water	kCal/kg	105.11
Enthalpy of steam generated in Boiler *i.e.* Enthalpy of steam at Turbine inlet	kCal/kg	774.7
Enthalpy of steam at Turbine outlet	kCal/kg	661.5
Enthalpy drop across the Turbine	kCal/kg	113.2
Crushing Season		
Power Generation		
Total power consumption for cane production-Total power output of the Reference Plant	MW	5.625
Auxillary power consumption of the Reference Plant	MW	1.3125
Net power output of the Reference Plant- Power required for the sugar plant	MW	4.3125
Annual net electricity generation in the Reference Plant	MWh	15525
Steam Generation		
Steam consumption for cane	%	48
Total steam required	TPH	90
MP steam required-Through PRDS	TPH	3
LP steam required	TPH	87
LP steam from TG	TPH	47.5
LP steam through PRDS and De-superheating	TPH	39.5
Enthalpy of LP steam required	kCal/kg	645
Enthalpy of HP steam from Boiler	kCal/kg	774.7
Temperature of De-superheating Water	^{0}C	105
Enthalpy of De-superheating Water	kCal/kg	105.1
HP steam through PRDS-to convert it into LP steam	TPH	31.9
Boiler Load	TPH	82.3
Bagasse Consumption		
Gross Calorific Value of Bagasse	kCal/kg	2272
Bagasse Consumption	TPH	35.7
Annual Bagasse Consumption for Crushing Season	Tonnes	128480
Efficiency of Reference Plant, $\varepsilon_{el,other\ plant(s)}$		**0.046**

Reference Plant (in absence of HCM Plant)											
Parameters	**Unit**	**Crediting Period**									
		Actual			**Proposed- As per Production Planning of HCM**						
		Nov'2003-Oct'2004	**Nov'2004-Oct'2005**	**Nov'2005-Oct'2006**	**Nov'2006-Oct'2007**	**Nov'2007-Oct'2008**	**Nov'2008-Oct'2009**	**Nov'2009-Oct'2010**	**Nov'2010-Oct'2011**	**Nov'2011-Oct'2012**	**Nov'2012-Oct'2013**
Reference Plant (in absence of HCM Plant)											
Crushing Season	days	106	134	150	152	157	163	166	166	163	167
Average cane crushing	TCD	3188	3869	4353	4600	4750	4900	5000	5100	5200	5500
Total cane crushed	Tonnes	337925	518403	652912	699200	745750	798700	830000	846600	847600	918500
Average bagasses generation	%	29.95	30.93	32.60	31.16	31.16	31.16	31.16	31.16	31.16	31.16
Bagasse generation at the Reference Plant	Tonnes	101209	160344	212851	217871	232376	248875	258628	263801	264112	286205
Crushing Season											
Power Generation											
Total electricity generation in the Reference Plant	MWh	11703	16168	19743	20976	22373	23961	24900	25398	25428	27555
Auxillary electricity consumption of the Reference Plant	MWh	2365	3629	4570	4894	5220	5591	5810	5926	5933	6430
Annual net electricity generation in the Reference Plant	MWh	9338	12539	15172	16082	17152	18370	19090	19472	19495	21126
Efficiency of Reference Plant											
Efficiency of Reference Plant		0.046									
Bagasse Consumption											
Gross Calorific Value of Bagasse	kCal/kg	2272	2272	2272	2272	2272	2272	2272	2272	2272	2272
Gross Calorific Value of Bagasse	GJ/Ton	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51
Annual Bagasse consumption Crushing Season	Tonnes	96834	133775	163353	173559	185114	198257	206027	210147	210395	227995

Reference Plant (in absence of HCM Plant)											
Parameters	Unit	Crediting Period									
		Actual			Proposed- As per Production Planning of HCM						
		Nov'2003-Oct'2004	Nov'2004-Oct'2005	Nov'2005-Oct'2006	Nov'2006-Oct'2007	Nov'2007-Oct'2008	Nov'2008-Oct'2009	Nov'2009-Oct'2010	Nov'2010-Oct'2011	Nov'2011-Oct'2012	Nov'2012-Oct'2013
Non-Crushing Season											
Power Consumption											
Electricity imported from the grid	MWh	No power generation in the Reference Plant- Entire power will be imported from the Grid.									
Bagasse Consumption											
Annual Bagasse consumption for Non-Crushing Season	Tonnes	Since there is no power generation in the Reference Plant, no bagasse will be consumed.									
Annual net electricity generation in the Reference Plant	MWh	9338	12539	15172	16082	17152	18370	19090	19472	19495	21126
Annual Bagasse consumption in the Reference Plant	Tonnes	96834	133775	163353	173559	185114	198257	206027	210147	210395	227995
Annual Bagasse sent for uncontrolled burning in the Reference Plant	Tonnes	4375	26569	49497	44312	47262	50618	52601	53653	53717	58210

HCM Project Activity											
Parameters	Unit	Crediting Period									
		Nov'2003-Oct'2004	Nov'2004-Oct'2005	Nov'2005-Oct'2006	Nov'2006-Oct'2007	Nov'2007-Oct'2008	Nov'2008-Oct'2009	Nov'2009-Oct'2010	Nov'2010-Oct'2011	Nov'2011-Oct'2012	Nov'2012-Oct'2013
HCM Plant											
Crushing Season	days	106	134	150	152	157	163	166	166	163	167
Average cane crushing	TCD	3188	3869	4353	4600	4750	4900	5000	5100	5200	5500
Total cane crushed	Tonnes	337925	518403	652912	699200	745750	798700	830000	846600	847600	918500
Average bagasses generation	%	29.95	30.93	32.60	31.16	31.16	31.16	31.16	31.16	31.16	31.16
Annual Bagasse generation at HCM Plant	Tonnes	101209	160344	212851	217871	232376	248875	258628	263801	264112	286205
Crushing Season+Non-crushing Season											
Power Generation											
Total electricity generation in the HCM Power Plant	MWh	84561.583	108751.345	163781.62	167520	167820	168180	168360	168360	168180	168420
Auxiliary electricity consumption of the HCM Power Plant	MWh	8925.689	10036.795	13113.576	15776	15774	15772	15770	15770	15772	15770
Annual net electricity generation in the HCM Power Plant, $EG_{project\ plant,y}$	MWh	75636	98715	150668	151744	152046	152408	152590	152590	152408	152650

HCM Project Activity											
Parameters	**Unit**	**Crediting Period**									
		Nov'2003-Oct'2004	**Nov'2004-Oct'2005**	**Nov'2005-Oct'2006**	**Nov'2006-Oct'2007**	**Nov'2007-Oct'2008**	**Nov'2008-Oct'2009**	**Nov'2009-Oct'2010**	**Nov'2010-Oct'2011**	**Nov'2011-Oct'2012**	**Nov'2012-Oct'2013**
Bagasse Consumption											
Annual Bagasse consumption in the HCM Power Plant	Tonnes	193657	231057	334316	340691	342727	345171	346392	346392	345171	346800
Annual net electricity generation in the HCM Power Plant, $EG_{project\ plant,y}$	MWh	75636	98715	150668	151744	152046	152408	152590	152590	152408	152650
Annual Bagasse consumption in the HCM Power Plant	Tonnes	193657	231057	334316	340691	342727	345171	346392	346392	345171	346800

Computation of Emission Reductions											
Parameters	Unit	Crediting Period									
		Nov'2003 -Oct'2004	Nov'2004 -Oct'2005	Nov'2005 -Oct'2006	Nov'2006 -Oct'2007	Nov'2007 -Oct'2008	Nov'2008 -Oct'2009	Nov'2009 -Oct'2010	Nov'2010 -Oct'2011	Nov'2011 -Oct'2012	Nov'2012 -Oct'2013
HCM Plant											
Annual net electricity generation in the HCM Power Plant, $EG_{project\ plant,y}$	MWh	75636	98715	150668	151744	152046	152408	152590	152590	152408	152650
Annual Bagasse consumption in the HCM Power Plant	Tonnes	193657	231057	334316	340691	342727	345171	346392	346392	345171	346800
Reference Plant											
Annual Bagasse sent for uncontrolled burning in the Reference Plant, $BF_{k,y2}$	Tonnes	4375	26569	49497	44312	47262	50618	52601	53653	53717	58210
Annual Bagasse consumption in the Reference Plant, $BF_{k,y1}$	Tonnes	96834	133775	163353	173559	185114	198257	206027	210147	210395	227995
Efficiency of Reference Plant, $\varepsilon_{el,other\ plant(s)}$		0.046									
Calorific Value of Bagasse, NCV_k	GJ/Ton	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51	9.51
Annual net electricity generation in the Reference Plant	MWh	11703	16168	19743	20976	22373	23961	24900	25398	25428	27555

Computation of Emission Reductions											
Parameters	**Unit**	**Crediting Period**									
		Nov'2003 -Oct'2004	**Nov'2004 -Oct'2005**	**Nov'2005 -Oct'2006**	**Nov'2006 -Oct'2007**	**Nov'2007 -Oct'2008**	**Nov'2008 -Oct'2009**	**Nov'2009 -Oct'2010**	**Nov'2010 -Oct'2011**	**Nov'2011 -Oct'2012**	**Nov'2012 -Oct'2013**
Computation of substitution of electrical energy from Northern Regional Grid											
Annual net electricity generation associated to B4 in the HCM Power Plant, $EG_{project\ plant,y1}$	MWh	37820	57153	73619	77303	82123	87540	90757	92572	92899	100356
Annual net electricity generation associated to B3 in the HCM Power Plant, $EG_{project\ plant,y2}$	MWh	1709	11351	22307	19737	20967	22350	23171	23635	23718	25622
EG_{y1}: Associated to efficiency improvement of the HCM project activity	MWh	26117	40985	53877	56327	59751	63579	65857	67174	67471	72801
EG_{y2}: Associated to bagasse that would have been burnt in an uncontrolled manner in absence of HCM project activity	MWh	1709	11351	22307	19737	20967	22350	23171	23635	23718	25622
Total EG_y	MWh	27826	52336	76184	76064	80718	85929	89028	90809	91189	98423
Emission Factor of Northern Regional Grid, EF_y	tCO_2/MWh	0.76043	0.76043	0.76043	0.76043	0.76043	0.76043	0.76043	0.76043	0.76043	0.76043
Baseline Emissions, BE_y	tCO_2/annum	21159	39798	57933	57841	61380	65342	67700	69054	69343	74844
Project Emissions, PE_y	tCO_2/annum	0	0	0	0	0	0	0	0	0	0
Leakage Emissions, L_y	tCO_2/annum	0	0	0	0	0	0	0	0	0	0
Emission Reductions, ER_y	tCO_2/annum	21159	39798	57933	57841	61380	65342	67700	69054	69343	74844
Total Emission Reductions over the Crediting Period	**tCO_2**	**584394**									

Annex 4

MONITORING INFORMATION

As per the requirement of CDM modalities, the CO_2 emission reduction resulting from the HCM project activity is required to be quantified in a transparent manner. The project proponent has therefore devised a robust monitoring protocol with the objective to have a clear, credible, and accurate set of monitoring, evaluation and verification procedures for the emission reduction resulting from the HCM project activity. 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 Monitoring Plan has been detailed below:

Description of the Monitoring Plan
1.0 Objective
The primary objectives of the 'Monitoring Plan' are to ▪ ensure proper and accurate monitoring of all the relevant project parameters as per the requirement of the CDM process ▪ ensure proper verification of the monitored parameters for their accuracy ▪ identify any discrepancy in the monitored parameters and the necessary corrective measures ▪ identify the scope for further development in the monitoring, reporting and data archiving process.
2.0 Instrumentation and Control System
The instrumentation and control system is the key aspect for salubrious functioning of any monitoring and verification system of a project activity. The HCM project activity has employed the state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters like total power generated, power consumption in the HCM sugar plant and in the HCM power plant, power export to UPPCL grid, total bagasse generated and consumed *etc*. 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.
3.0 Monitoring Parameters for the computation of Emission Reductions
3.1 Primary Parameters for the computation of Baseline Emissions The following primary parameters are required to be monitored for the computation of baseline emission for the HCM project activity:
3.1.1 Net quantity of electricity generated in the HCM project plant during the year y ($EG_{project}$

$_{plant,y}$)   Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.1.2 Total quantum of bagasse residues consumed in the HCM project plant   Bagasse generated in the HCM sugar plant and bagasse from other unit of BCML (Babhnan Unit) or bagasse from market is consumed in the HCM project plant. 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 is 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 and magnetic separator. Metal detector, tramp iron separator *etc.* prevent any metal particles entering into the boiler and ensure that only fuel is conveyed to the boiler.   Data Reporting and verification: The total quantum of bagasse consumed in the HCM project plant is determined based on the steam to fuel (bagasse) ratio of the boiler installed in the HCM project plant. The parameter is reported in the daily report and is discussed in the morning meeting. The monthly report, which includes this parameter, is also discussed in the morning meeting and the Management Review Meeting conducted every three months. Discrepancy, if identified, is addressed immediately.   Uncertainty Analysis: The steam to fuel ratio of the boiler of the HCM project plant can be verified from time to time. Furthermore the total quantum of bagasse consumed in the HCM project plant can also be cross-verified with the total bagasse generated in the HCM sugar plant and the bagasse received from other unit of BCML or market. This will ensure lower uncertainty level of the parameter.
3.1.3 Quantity of bagasse residue of type k generated in the HCM sugar plant during the year y ($BF_{k,y}$)   Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.1.4 Net calorific value of bagasse residue of type k combusted in the HCM power plant (NCV_k)   Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.2 Secondary Parameters for the computation of Baseline Emissions   The following secondary parameters are required to be monitored for the computation of baseline

emission for the HCM project activity:
3.2.1 Net quantity of electricity generated in the HCM power plant during the year y using the same quantity of bagasse residues fired in the reference plant ($EG_{projectplant,y1}$) The parameters will be computed based on the parameters 3.1.1, 3.1.2 and 3.2.3. Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.2.2. Net quantity of electricity generated in the HCM power plant during the year y using bagasse residues that would otherwise be burned in an uncontrolled manner ($EG_{projectplant,y2}$) The parameters will be computed based on the parameters 3.1.1, 3.1.2 and 3.2.4. Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.2.3 Quantity of bagasse residues of type k which otherwise would have been combusted in the reference plant in absence of the HCM project activity during the year y ($BF_{k,y1}$) The parameter will be determined based on ▪ Total electricity which otherwise would have been generated in the reference plant in absence of the HCM project activity during the crushing season- Total electricity generated in the reference plant during the crushing season caters to the power requirement of the sugar plant and the auxiliary consumption of the reference plant. Power requirement of the sugar plant is determined from the net power consumed in the HCM sugar plant during the crushing season. The auxiliary power consumption of the reference plant is determined based on a similar unit of BCML at the start of the crediting period and it will remain fixed for the entire crediting period. ▪ Average net energy efficiency of electricity generation in the reference plant- This is determined based on a similar unit of BCML at the start of the crediting period. The same can always be cross-verified. ▪ Net Calorific Value of the bagasse residue (*i.e.* parameter 3.1.4) Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.2.4 Quantity of bagasse residues of type k which otherwise would have been burned in an uncontrolled manner in absence of the HCM project activity during the year y ($BF_{k,y2}$) The parameter will be determined as a difference between the parameters 3.1.3 and 3.2.3. Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameter.
3.3 Parameters for the computation of Project Emissions

The following parameters are required to be monitored for the computation of project emission for the HCM project activity:
3.3.1 Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y ($FF_{project\ plant,i,y}$) 3.3.2 Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y ($FF_{project\ site.i,y}$) 3.3.3 Net calorific Value of the fossil fuel type i (NCV_i) 3.3.4 CO_2 emission factor of the fossil fuel type i ($COEF_i$) Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameters.
3.3 Parameters for the computation of Leakage Emissions The following parameters are required to be monitored for the computation of leakage emission for the HCM project activity:
3.3.1 Quantity of bagasse residue of type i for which leakage could not be ruled out using one of the approaches in the baseline methodology ($BF_{i,y}$) 3.3.2 CO_2 emission coefficient for most intensive fuel in the calculation of combined margin with methodology ACM0002/ Version 06 ($COEF_i$) 3.3.3 Quantity of biomass residue of type k that is available in surplus in the region/country ($BF_{y,surplus}$) Please refer to Section B.7.1 of the PDD for further details on the monitoring procedure, data reporting, verification procedure and uncertainty analysis of the parameters.
4.0 Roles and Responsibility
The data on electricity generation and bagasse consumption will be monitored by the Plant Operator and recorded in the Plant Log Book. The same will be verified by the Shift-in-charge and daily and monthly reports will be prepared based on the same. The daily and monthly reports will be discussed in the morning meeting in the presence of all the departmental heads. Internal Audit will be conducted every year and discrepancies, if identified, will immediately be addressed.

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