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

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SECTION A. General description of project activity

A.1 Title of the project activity:

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20 MW Bagasse Based Co-generation Power Project at Bannari Amman Sugars Limited, Nanjangud, Karnataka

Version 05

24/10/2008

A.2. Description of the project activity:

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Purpose:

The primary purpose of the project activity is to increase the quantity of power generation using the sugar factory generated bagasse and export the resulting surplus power to the state electricity grid.

- Description:

M/s Bannari Amman Sugars Limited (BASL), part of the Bannari Amman group, is a multifaceted corporate conglomerate headquartered at Coimbatore, South India. BASL is engaged in the manufacturing of sugar, industrial alcohols, granites and recently, power generation & distribution. The CDM project activity has been implemented at one of the BASL's sugar factories located at Nanjangud, Karnataka. The sugar factory had an average crushing capacity of 5000 tons of cane per day (TCD) in 2003 and expanded to 7500 TCD in 2005. Subsequently, the factory generates bagasse in surplus of the captive energy requirements. In the business as usual scenario, BASL would have continued with the existing cogeneration system and the surplus bagasse left to decay. However, the company has commissioned a 20 MW cogeneration power project (the "project activity") at the Nanjangud sugar mill to utilize the surplus bagasse and generate additional power. The cogeneration plant is exporting surplus power to the Chamundeswari Electricity Supply Company (CESCOM)[1] at Karnataka, after meeting the sugar plant requirement of steam and power.

[1] CESCOM was unbundled from Karnataka Power Transmission Corporation Limited (KPTCL) in line with the Electricity Act, 2003 of Government of India.

Project's contribution to sustainable development

The project activity is a renewable energy power project, which uses bagasse generated from sugar mill as fuel for power generation and exports clean power to southern regional grid. This electricity generation substitutes the power generation by carbon intensive southern regional grid, which uses carbon emissive conventional fuels like coal, diesel/oil, natural gas etc. The project activity reduces CO_2 emission and also conserves fossil fuels for other purposes. Therefore this project activity has excellent environment benefits in terms of reduction in carbon emissions and natural resource conservation.

This project activity is in a rural setting and will contribute to the environmental & social issues locally and globally by:

- Exporting renewable energy to the southern regional grid, thereby eliminating the generation of equivalent quantity of power using conventional fuels.
- Making coal available for other important applications.
- Contributing to a small increase in the local employment in the area of skilled & unskilled jobs for operation and maintenance of the equipment.
- Capacity building of rural workforce in modern technology power generation.
- Improvement of quality of life of local people by providing inflow of funds, additional employment, technological & managerial capacity building, better social welfare etc.
- Better power quality in the surrounding area contributing to economical improvement.

A.3. Project participants:

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Name of Party involved (*) (host indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
India (Host Country)	Bannari Amman Sugars Limited	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
India

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

>>
Karnataka

A.4.1.3. City/Town/Community etc:

>>
Alaganchi Village, Nanjangud Taluk, Mysore District

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

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BASL's project activity is located in its sugar factory, from where bagasse is fed to the 120-TPH boiler. The plant is situated at latitude 12.07°N and longitude 76.44°E in Alaganchi Village, Nanjangud Taluk, Mysore District, Karnataka State. The site is 35 Kilometres (KMs) away from Mysore. The nearest airport is at Bangalore and nearest major railway station at Mysore. The water requirement is met through Kabini River, which is 6 KMs from the site. The raw material for the sugar factory (Sugar cane) is procured from a radial distance of around 60 to 70 KMs. CESCOM's electrical sub-station of 20 MVA for power export is situated at 5.5 KMs to the project site. The site is well connected by road and provided with adequate space, fuel, water and grid interconnection facilities. The geographical location of the project activity is indicated in the diagrams below:

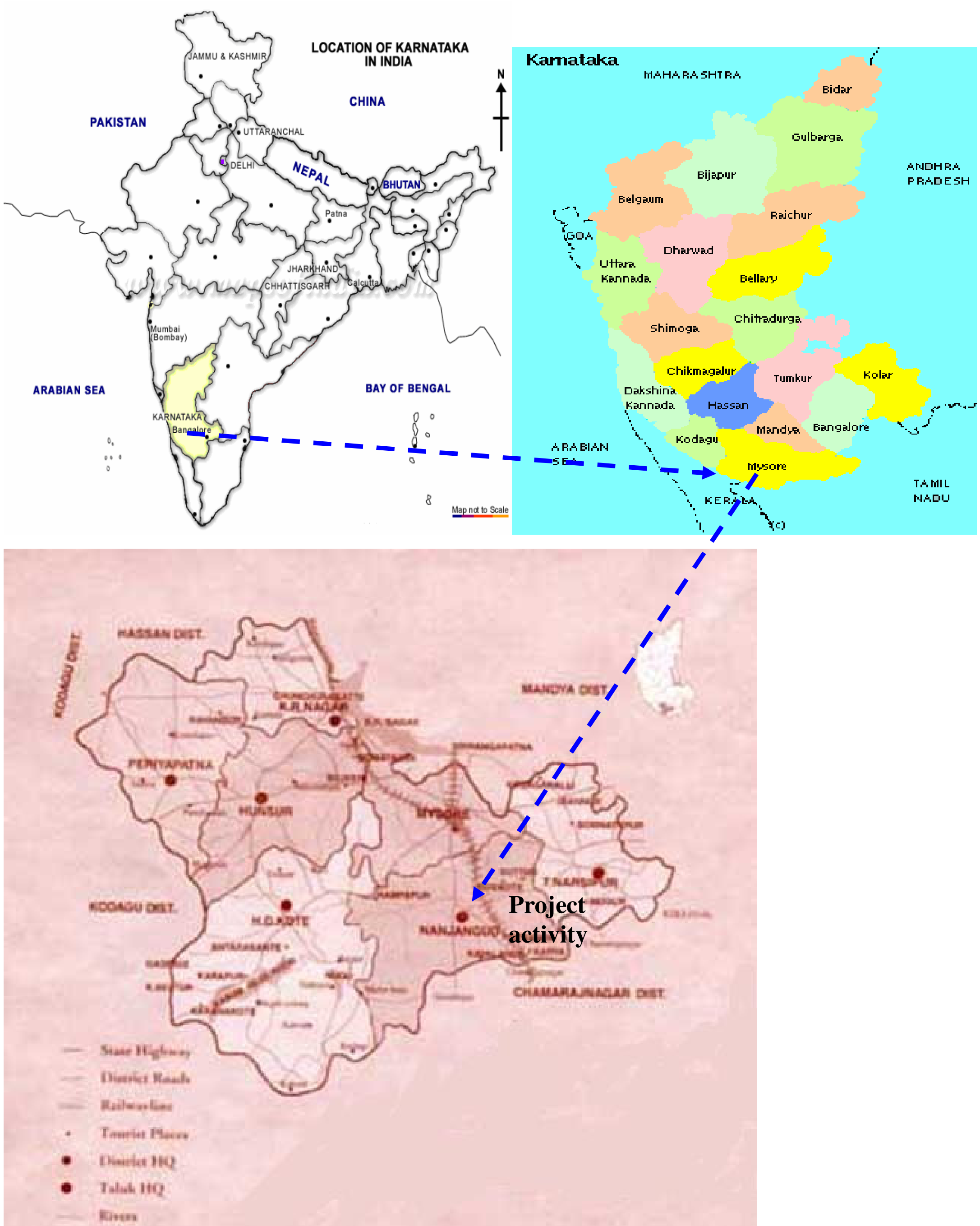

Figure A.1: Location of the project activity

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

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The project activity generates electricity from bagasse, which is a renewable fuel and therefore can be categorized under **"Category 1: Energy industries (renewable / non-renewable sources)"** as prescribed in the latest 'List of Sectoral Scopes' available at UNFCCC website.

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

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The project activity involves the modified Rankine cycle method for electricity generation. The major equipments constituting the project activity are the high pressure boiler and a steam driven turbo generator (TG) set. Bagasse from the sugar factory is fired in the boiler to generate steam. The boiler is rated to generate 120 tonnes per hour (TPH) steam at an outlet steam configuration of 67 ata and 485ºC. The TG set is of extraction cum backpressure type with a rated nominal electricity output of 20 MW. The steam generated in the high pressure boiler is inlet to the TG set at a pressure of 67 ata to generate electricity. The small quantity of steam extracted at 8 ata and the rest exiting at 2.5 ata are used in the sugar manufacturing process. The boiler and turbo generators are fully automated to improve the operational efficiency.

Feed water system (Raw water and DM water system), condensate pumps, water treatment plant, cooling water system, draft fans, fuel and ash handling system, Instrument air system etc are auxiliaries to the cogeneration plant for its successful and environment friendly operation. All induced draft, fixed draft, secondary air fans and boiler feed pumps are fitted with variable frequency drives for energy conservation. To reduce blow-down, water quality is maintained at the required parameter and make-up water is used from D.M. plant. Electrostatic precipitators are installed to limit emissions to air within allowable safe limits.

The unit is operated in synchronization with their existing 16 MW cogeneration plant. Electrical system and EHV transmission system has been provided to facilitate the export of power to the grid. Electricity is generated at 11 kV and stepped up to 66 kV for export to the grid. Electricity for captive and auxiliary consumption is used after stepping it down to 415 V. As the project activity is with an extraction cum backpressure turbine, it would operate only during the crushing season of around 280 days in a year.

In order to have clarity on the power generation and export details from the project activity, the various scenarios of the project activity have been defined below:

Pre-Project Scenario: Scenario where a 16 MW (67 ata) cogeneration system is operating to meet the captive energy requirements of the 5000 TCD sugar plant and exports the surplus power to the grid.

Baseline Scenario (As identified in section B.4 and B.5 below)**:** The sugar plant capacity is expanded from 5000 TCD to 7500 TCD. In the business as usual (baseline) scenario, BASL would have planned and met its additional captive energy requirements (of the increased sugar plant capacity) from the existing cogeneration systems and from a new low pressure "heat only" boiler to meet the marginally higher steam requirement, as is common practice in the Indian sugar industry. Apart from consumption of the factory generated bagasse in boilers for steam generation, the surplus would have been left to decay since the area is surplus in biomass residues.

CDM project Scenario: The sugar plant capacity is expanded from 5000 TCD to 7500 TCD. BASL conceptualizes an environmental friendly CDM project; a new 20 MW cogeneration plant under CDM to meet the additional energy requirements and generate incremental electricity for grid export. The 20 MW project activity is commissioned in March 2004. Parallel operation of the existing 16 MW system and the new 20 MW, 67 ata, cogeneration system. Surplus bagasse generation from the sugar plant is used in the new 20 MW system. The total power exported is expected to increase to around 22 MW from 2007 onwards[2]. A net surplus of 12 MW from 2007 onwards is expected to be generated by the new 20 MW system. The net quantity of increased electrical energy generation as a result of the project activity (i.e. incremental to the baseline generation) during the 10-year crediting period works out to around 848.93 Million kWh or 848,930 MWh.

Since the project activity involves advanced cogeneration configuration, the Operation and Maintenance (O&M) personnel need to be trained for the proper operation of the plant. BASL would organise periodic internal training programs for the team conducted by experienced team members[3]. Further, the personnel would be sent for external trainings on a need basis.

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[2] Power export to the grid has increased from 12 MW in the pre-project scenario to 16.5 MW post-project in 2005 against the expected 22 MW. This was because the cane crushing and thus bagasse generation was below the rated capacity due to reduced cane output as a result of drought. From 2007 onwards, full capacity crushing is expected and therefore surplus bagasse quantity available for combustion in the project activity will increase enabling export of 22 MW.

[3] Proof of internal training given would be submitted to the DOE

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
April 2008 – March 2009	72,158
Apr 2009 - Mar 2010	72,158
Apr 2010 - Mar 2011	72,158
Apr 2011 - Mar 2012	72,158
Apr 2012 - Mar 2013	72,158
Apr 2013 – Mar 2014	72,158
Apr 2014 - Mar 2015	72,158
Apr 2015 - Mar 2016	72,158
Apr 2016 - Mar 2017	72,158
Apr 2017 - Mar 2018	72,158
Total estimated reductions (tones of CO_2e)	721,580
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	72,158

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology

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

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Title: "Consolidated methodology for grid-connected electricity generation from biomass residues" ACM0006 Version 04

Reference -This is an UNFCCC consolidated baseline methodology (ACM0006), based on the following approved methodologies:

- AM0004: Grid connected biomass power – generation that avoids uncontrolled burning of biomass
- AM0015: Bagasse based cogeneration connected to an electricity grid which is based on Vale do Rosario Bagasse cogeneration project in Brazil
- NM0050: "Ratchasima SPP Expansion Project in Thailand"
- NM0081: "Trupan biomass cogeneration project in Chile"
- NM0098: "Nobrecel Fossil to Biomass fuel switch project in Brazil"

The methodology also refers to ACM0002 ("Consolidated baseline methodology for grid connected electricity generation from renewable sources") and the latest version of the "Tool for the demonstration and assessment of additionality"

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

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The project activity is bagasse based renewable energy power project, which feeds surplus electricity (power) to the Southern Regional grid. The selected methodology available on the UNFCCC web site is applicable to "grid connected and biomass-residue fired electricity generation from biomass residues" and is the most suitable approved UNFCCC methodology available for the project activity.

Conditions of ACM0006	**Applicability to the project activity**
Applicable to grid connected and biomass residue fired electricity generation project activities	Bagasse fired in the project activity is a biomass residue. The project activity is connected to the southern regional grid to which it exports surplus electricity
Installation of a new biomass residue fired power generation unit, which replaces or is operated next to existing biomass residue fired power generation capacity	The project involves the installation of a 20 MW bagasse fired power generation unit which is operated next to an existing biomass residue fired power plant
May be based on the operation of a power generation unit located in an agro-industrial plant generating the biomass residues	Based on the operation of a power generation unit located in a sugar plant generating the bagasse.
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.	Bagasse used in the project activity is a residue from agriculture related industry (sugar plant). Minor quantities of other agricultural residues like cane trash and corn cobs may used during emergency situations.
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).	Bagasse will be used as the predominant fuel, however, some amount of coal may be co-fired during drought or other emergency situations.

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.	The project activity uses the residue (bagasse) from sugar manufacturing. The production process is independent of the project activity. The project activity has not resulted in increase of the sugar plant crushing capacity as explained below: The sugar plant at Nanjangud was operating with a crushing capacity of 5000 Tonnes Cane per Day (TCD). The crushing capacity of the sugar mill to 7500 TCD was planned considering the improved cane availability (as a result of the various cane development activities of the company in the previous years). This was conceptualized and planned as early as May 2001 (well ahead of the project activity planned in June 2002) which is evident from the Industrial Entrepreneurs Memorandum (IEM) filed with the Ministry of Commerce and Industry dated 09.05.2001 (submitted to DOE). Subsequently, the purchase orders for the sugar mill equipments were placed during June 2002 (Copy of purchase orders submitted to DOE), ahead of that of the project activity in September 2002. It is clear from the above that the conceptualization of the crushing capacity expansion (May 2001) was well in advance of the project activity (June 2002). The increase in crushing capacity would have happened even in the absence of the project activity The increased crushing capacity could have operated with the existing cogeneration system. The surplus bagasse that would be generated with the increased crushing capacity would have been

	left to decay. The project activity was implemented only with the idea of generating and exporting additional power to the grid.
The biomass used by the project facility should not be stored for more than one year.	Bagasse is not stored on the site for more than one year.
No significant energy quantities, except from transportation of the biomass, are required to prepare the biomass residues for fuel combustion	The preparation of bagasse doesn't involve significant energy consumption. Some quantity of energy may be used for biomass transportation from outside during unavailability of bagasse.
The methodology is only applicable for the 17 combinations of project activities and baseline scenarios identified in the methodology.	Project activity fits in scenario 16.

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

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The spatial extent of the project boundary encompasses:

- The power plant at the project site
- The means for transportation of biomass residues to project site
- All power plants connected to the electricity grid

The spatial extent of the project boundary is depicted in the figure below:

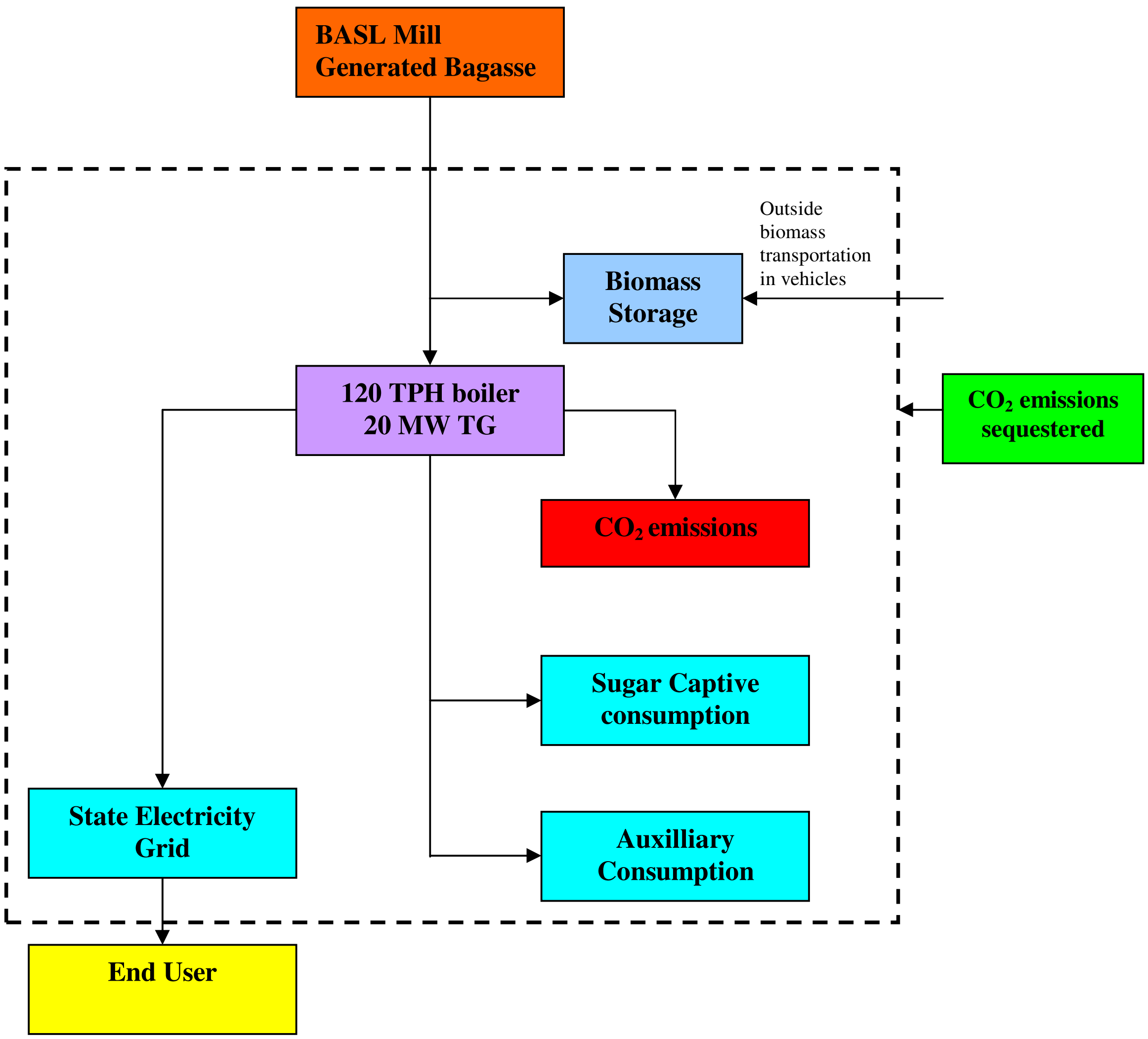

Figure B.1: Project boundary

Emission sources included in the project boundary:

The project participants have included in the project boundary, GHG emissions sources from the project activity and emission sources in the baseline, as prescribed by the methodology ACM0006 Ver 04. The project boundary includes the following emission sources:

	Source	Gas		Justification/Explanation
Baseline Scenario	Grid Electricity Generation	CO_2	Included	Main Emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat Generation in Onsite boilers	CO_2	Excluded	Heat generation is using biomass as fuel.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Decay or uncontrolled burning of surplus biomass	CO_2	Excluded	No surplus biomass
		CH_4	Excluded	No surplus biomass
		N_2O	Excluded	No surplus biomass
Project Scenario	Onsite fossil fuel combustion due to the project activity	CO_2	Included	Important emission source.
		CH_4	Excluded	Excluded for simplification. This quantity is very small.

		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Offsite transportation of biomass	CO_2	Included	An important emission source.
		CH_4	Excluded	Excluded for simplification. This quantity is very small.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Combustion of biomass for electricity and/or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	This emission source must be included only if CH4 emissions from uncontrolled burning or decay of biomass in the baseline scenario are included.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Biomass storage	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.

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

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As prescribed by ACM0006 version 04, project participants have determined the baseline scenario and demonstrated additionality using the "Tool for the demonstration and assessment of additionality" (version 03) shown in Figure B.2 in section B.5 below.

As per ACM0006, project participants have determined the most plausible baseline scenario among all realistic and credible alternatives separately regarding:

- How power would be generated in the absence of the CDM project activity
- What would happen to the biomass in the absence of the project activity
- In case of cogeneration projects: how heat would be generated in the absence of the project activity

IDENTIFICATION OF THE MOST PLAUSIBLE BASELINE SCENARIO

The various alternatives to the project activity are being identified in this section separately for power, heat and biomass. The main criteria for identifying the alternatives are that they should be able to deliver services and output equivalent to that of the project activity.

The alternative scenarios would involve how BASL opted to deal with its power and steam requirements and the bagasse generated as a result of the sugar plant capacity expansion from 5000 TCD to 7500 TCD. The crushing capacity expansion increased the sugar plant power requirements from around 6 MW to 8 MW and steam requirement from around 90 TPH to 140 TPH. In the absence of the CDM project activity, BASL had the following options for power, heat and biomass.

Alternatives available for power generation:

P1 The proposed project activity not undertaken as a CDM project activity

This is a possible alternative scenario for the power generated in the project activity

P2 The proposed project activity (installation of a power plant), fired with the same type of biomass residues but with a lower efficiency of electrical generation (e.g. an efficiency that is common practice in the relevant industry sector)

This is a possible alternative to the power generated in the project activity. However this may not be a credible alternative since there is already a biomass residue fired cogeneration plant with a similar efficiency (67 ATA) as the project plant existing at the project site. Installation of a lower efficiency system would create problems in the collateral operation of the two grid connected cogeneration plants. Since BASL's cogeneration setup and associated systems are already configured for 67 ATA, it would not be preferable to install a lower pressure (45 ATA) system. Therefore, this alternative is not considered further.

P3 The generation of power in an existing captive power plant, using only fossil fuels
This is not an alternative to power generation since there is no fossil fuel based power plant at the site. Therefore, this alternative is not considered further.

P4 The generation of power in the grid
This is a possible alternative scenario for the power generated in the project plant. The entire quantity of power generated in the project activity or part of it could be generated in the grid. However, the option of 100% of power generation of project plant to be generated in the grid is not a credible option since captive cogeneration is an essential aspect in sugar mills for economical operation. However, the incremental power generation between the project plant and other power generation alternatives would be generated in the grid. Therefore option P4 will not be a stand alone alternative, rather, it would be combined with other alternatives (as in option P5 below).

P5 The continuation of power generation in an existing biomass residue fired power 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
This is a possible alternative scenario for the power generated in the project activity. In this case, since the quantity of power generation would be smaller than the project plant, the incremental electricity generation would have been generated in the grid (Option P4).

P6 The continuation of power generation in an existing biomass residue fired power plant, fired with the same type of biomass residues 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.

This is a possible alternative scenario for the power generated in the project activity. However, at the end of the lifetime of the existing plant, higher efficiency technology (similar to the project activity) would have penetrated the sector to a good extent. BASL would rather implement the higher efficiency technology than a similar new plant. Therefore, this alternative is not considered further.

Alternatives available for heat (process steam) generation:

H1 The proposed project activity not undertaken as a CDM project activity

This is a possible alterative to the heat generated in the project activity

H2 The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass residues but with a different efficiency of heat generation (e.g. an efficiency that is common practice in the relevant industry sector)

This is a possible alterative to the heat generated in the project activity. However this may not be a credible alternative since there is already a biomass residue fired cogeneration plant with a similar efficiency (67 ATA) as the project plant existing at the project site. Installation of a lower efficiency system would create problems in the collateral operation of the two cogeneration plants. Since BASL's cogeneration setup and associated systems are already configured for 67 ATA, it would not be preferable to install a lower pressure (45 ATA) system. Therefore, this alternative is not considered further.

H3 The generation of heat in an existing captive cogeneration plant, using only fossil fuels

This is a not a credible alterative to the heat generated in the project activity as there is no fossil fuel based captive cogeneration plant at the project site.

H4 The generation of heat in boilers using the same type of biomass residues

This is a possible and realistic alterative to the heat generated in the project activity. In the absence of the project activity, BASL cannot meet its increased steam requirement from the existing cogeneration system since their capacity would not be sufficient. The only option for BASL would either be to install a low pressure heat only boiler (this option H4) or to implement the proposed project activity (option H1 above, which is already selected as one of the possible alternatives).

H5 The continuation of heat generation in an existing biomass residue fired cogeneration 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.
This is not a possible alterative to the heat generated in the project activity since the existing units did not have sufficient capacity to meet the additional steam requirements of the sugar plant[4]*. Therefore, this alternative is not considered further.*

H6 The generation of heat in boilers using fossil fuels
This is a possible alterative to the heat generated in the project activity. However, it is not a realistic alternative since cogeneration of heat and power from biomass residues is the established norm in sugar industries. Combustion of fossil fuels in heat only boilers is an inefficient and uneconomic method compared to biomass cogeneration and therefore cogeneration of power is an inherent and necessary component of any modern sugar mill from efficiency and economic point of view. Therefore, this alternative is not considered further.

H7 The use of heat from external sources, such as district heat
This is a possible alterative to the heat generated in the project activity. However, it is not a realistic alternative since cogeneration of heat and power from biomass residues is the established norm in sugar industries. Use of heat from external sources is an uneconomic method compared to biomass cogeneration and therefore cogeneration of power is an inherent and necessary component of any modern sugar mill from efficiency and economic point of view. Therefore, this alternative is not considered further.

H8 Other heat generation technologies (e.g. heat pumps or solar energy)
This is a possible alterative to the heat generated in the project activity. However, it is not a realistic alternative since cogeneration of heat and power from biomass residues is the established norm in sugar industries. Heat generation from other technologies is an uneconomic method compared to biomass cogeneration and therefore cogeneration of power is an inherent and necessary component of any modern

[4] *The total steam generation capacity of the existing plant is only 80 TPH against the total demand of 140 TPH of the 7500 TCD sugar plant*

sugar mill from efficiency and economic point of view. Therefore, this alternative is not considered further.

Alternatives available for biomass:

B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
This is a possible alternative scenario for the biomass used in the project activity. In the absence of the project activity, BASL would be left with surplus[5] *biomass residues that have to be dumped in the fields.*

B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.
This is a possible alternative scenario for the biomass used in the project activity. However, it is not a realistic alternative as there are no landfills of more than 5 meters depth in the vicinity. Any surplus biomass residues are disposed in fields under aerobic conditions only. Therefore, this alternative is not considered further.

B3 The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.
This is a possible alternative scenario for the biomass used in the project activity. However, it may not be a realistic alternative since surplus biomass residues are dumped in fields to decay. Uncontrolled burning is not a practice followed in the area. Therefore, this alternative is not considered further.

B4 The biomass residues are used for heat and/or electricity generation at the project site
This is a possible alternative scenario for the biomass used in the project activity. BASL may partly use the biomass residues in boilers for heat generation and the surplus would be left to decay.

B5 The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plant
This is a possible alternative scenario for the biomass used in the project activity. However, it may not be a realistic alternative since the area is surplus in biomass. Therefore, BASL would have to dump the surplus biomass residues. Therefore, this alternative is not considered further.

B6 The biomass residues are used for heat generation in other existing or new boilers at other sites
This is a possible alternative scenario for the biomass used in the project activity. However, it may not be a realistic alternative since the area is surplus in biomass. Therefore, BASL would have to dump the surplus biomass residues. Therefore, this alternative is not considered further.

B7 The biomass residues are used for other energy purposes, such as the generation of biofuels
This is a possible alternative scenario for the biomass used in the project activity. However, it may not be a realistic alternative since the area is surplus in biomass. Therefore, BASL would have to dump the surplus biomass residues. Therefore, this alternative is not considered further.

B8 The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry)
This is a possible alternative scenario for the biomass used in the project activity. However, it may not be a realistic alternative since the area is surplus in biomass. Therefore, BASL would have to dump the surplus biomass residues. Therefore, this alternative is not considered further.

List of plausible alternative scenarios to the project activity:

- ***Identified credible alternatives for power generation are P4 and P6.***
- ***Identified credible alternative for heat generation is H4.***
- ***Identified credible alternatives for biomass residues are B1 and B4.***

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[5] Energy balance for the scenario would be submitted to DOE to show surplus availability of biomass residues. Further, as the region is surplus in biomass (as per data from Karnataka Renewable Energy Development Agency Limited), BASL would have no other option than to dump the surplus bagasse

Realistic and credible combinations of the alternatives for power, heat and biomass residues identified above are considered as plausible alternatives to the project activity and are listed below. These alternatives are in line with the combinations (scenarios) listed in ACM0006 version 04.

Baseline Alternative 1 (BA1):

Combination of P1, H1 and B4. This alternative would involve:

- Implementation of the project activity not undertaken as a CDM project activity.
- Installation of a 67 ata high pressure 20 MW cogeneration system. BASL could have installed the 20 MW plant without undertaking it as a CDM activity.
- The existing 67 ata 16 MW biomass residue fired power plant would continue operating.
- The additional heat and power requirements due to the sugar plant capacity expansion would be met by the 20 MW system and the surplus power would be exported to the grid

BASL needed to deal with its additional power and steam requirements and the bagasse generated as a result of the sugar plant capacity expansion from 5000 TCD to 7500 TCD. The crushing capacity expansion increased the sugar plant power requirements and steam requirement. In this situation, BASL had the option to install a high pressure cogeneration system of 20 MW without undertaking it as a CDM project activity and operate it along with the existing 16 MW system. There was no restriction on BASL to implement the above alternative and export additional surplus power.

Baseline Alternative 2 (BA2):

Combination of P4, P6, H4, B1 and B4. This alternative would involve:

- Continuation of the existing biomass residue fired systems using the same type of biomass residues as in the project activity
- A low pressure boiler to meet the additional process steam requirements of the sugar plant capacity expansion
- The additional power requirements due to the sugar plant capacity expansion would be met by the existing biomass power plant. The surplus after meeting the total captive power requirements would be exported to the grid.
- Surplus bagasse would be dumped or left to decay

To deal with the additional steam and power requirements, BASL had the option to tap the surplus power from its existing 16 MW power plant and to generate steam in a low pressure boiler. The surplus bagasse could be left to decay.

As per ACM0006, the step 3 (barrier analysis) of the "Tool for the demonstration and assessment of additionality" version 03 is used to determine the most plausible baseline scenario among the above two alternatives.

Barrier analysis of the alternatives:

An analysis of the barriers facing the baseline alternatives is provided in section B.5. The analysis demonstrates that the alternative 1 (BA1) faces technological and other barriers that would prohibit its implementation. These barriers and other barriers do not prevent the baseline alternative 2 (BA2) from occurring. Thus, BA2 is selected as the most plausible baseline scenario.

Most plausible baseline scenario for the project activity:

Baseline Alternative 2 (BA2):

Combination of P4, P6, H4, B1 and B4. This alternative would involve:

- Continuation of the existing biomass residue fired systems (16 MW system) using the same type of biomass residues as in the project activity
- A low pressure boiler to meet the additional process steam requirements of the sugar plant capacity expansion
- The additional power requirements due to the sugar plant capacity expansion would be met by the existing biomass power plant. The surplus after meeting the total captive power requirements would be exported to the grid.
- Surplus bagasse would be dumped or left to decay

It may be noted that a 7.5 MW system was in operation at the site when the processing capacity was 2500 TCD. During the capacity expansion to 5000 TCD (year 1999-2000), an improved efficiency cogeneration system of 16MW capable to serve the entire power-steam demand of the sugar unit was installed to replace[6] the inefficient 7.5 MW system. The old 7.5 MW unit was planned to be abandoned once the 16MW plant gets operational at its full capacity. Accordingly it operated parallel to the 16MW cogen plant only during the stabilization period and got dismantled in 2004. During the second expansion of the sugar manufacturing unit to 7500 TCD, the options available to the project proponent were:

- Continuation of the existing 16 MW system and installation of a low pressure bagasse fired boiler to meet part of the steam requirement (baseline scenario) or
- Continuation of the existing 16 MW system and installation of a 20MW additional cogen plant and supply excess power to grid. (project activity)

A detailed mass and energy balance of the baseline scenario and project scenario is provided in Appendix C and also in the CER calculation sheet being submitted.

The baseline alternative (BA2) arrived corresponds to scenario 16 of ACM0006. The description of scenario 16 as per ACM0006 version 04 and justification of how this baseline alternative falls under this scenario is provided below:

Definition of Scenario 16	**Applicability to the project activity**
The project activity involves the installation of a new biomass residue fired cogeneration unit, which is operated next to (an) existing biomass residue fired power generation unit(s). The existing units are only fired with biomass residues and continue to operate in the same manner after installation of the new power unit.	Applicable. The project is the installation of a new 20 MW biomass cogeneration unit which is operated next to the existing 16 MW plant. The existing 16 MW unit is only fired with biomass residues and continues to operate in the same manner after installation of the new power unit.
The power generated by the project plant would in the absence of the project activity be generated (a) mostly in power plants in the grid (i.e. the power generated by the new power unit is fed into the grid or would in the absence of the project activity be purchased from the grid) and may (b) to a small extent be generated in the existing power plant(s).	The power generated by the 20 MW plant would in the absence of the project activity be generated mostly in the grid and partly in the existing power plant.
The biomass residues would in the absence of the	In the absence of the project activity, BASL would

[6] Detailed Project Report of 16MW cogen plant – extract of which is submitted to DOE for verification

project activity (partly) be used for heat generation in boilers at the project site and may, in addition, partly be used in the existing power plant(s) and/or partly be dumped or left to decay or burnt in an uncontrolled manner without utilizing it for energy purposes.	utilise the bagasse in the existing power plants and in low pressure boiler to meet the additional steam requirements of the increased sugar plant capacity. The surplus bagasse would be left to decay.
The heat generated by the project plant would in the absence of the project activity be generated in on-site boilers fired (a) partly with the biomass residues that are used in the project plant and (b) partly with fossil fuels.	The heat generated by the 20 MW plant would in the absence of the project activity be generated in on-site boilers using biomass residue used in the 20 MW plant.

Justification that surplus bagasse would be left to decay:

Please note that the project activity is located in a remote area. In the area surrounding the project site, there is surplus availability of biomass residues. During Validation, information was obtained from the state nodal agency for renewable energy, Karnataka Renewable Energy Development Limited (KREDL), on the surplus availability of biomass residues in the region (Letter from KREDL submitted to DOE) covering two districts. As indicated by KREDL, following is the availability of biomass in the region:

Parameter	**Quantity**	**Remarks**
Surplus availability in Mysore district	295680 Tonnes	KREDL data
Surplus availability in Chamraj Nagar district	19880 Tonnes	KREDL data
Total surplus biomass available in the region	315560 Tonnes	KREDL data
Proposed capacity of biomass power plants in the region	19.5 MW	KREDL data
Specific Fuel Consumption (SFC) for biomass power plants	1.16 Tonnes / MWh	Based on KERC tariff order submitted to DOE
Biomass required for 19.5 MW power plants	198152 Tonnes	Based on above SFC and 100% PLF
Surplus available after meeting	117409 Tonnes	40% is surplus

demand of power plants		

It may be noted that apart from the maximum consumption for 19.5 MW biomass power plants, there is 40% surplus biomass availability in the region which is left to decay or burnt without use. Further, independent biomass power producers would not prefer to use bagasse as the fuel owing to the high moisture content and lower calorific value compared to other biomass residues. Also, cost of transportation and storage area requirement is higher due to high moisture content. Unless specifically designed for bagasse, the normal boilers would encounter problems with performance and maintenance. Considering all the above factors, it is unlikely that our surplus bagasse would be sought by these power producers, and therefore would be left to decay as it is of no sale value.

Thus, the BA2 clearly falls under scenario 16 of ACM0006 version 04.

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): >>

In order to demonstrate that the CDM project activity reduces anthropogenic GHG emissions that would have occurred in the absence of the project activity, it is necessary to prove that:

- The implementation of the project activity is not the baseline scenario, (i.e., under normal circumstances, there would be no power capacity expansion and thereby BASL would not export additional power to the grid).

ACM0006 version 04 prescribes the use of the "Tool for the demonstration and assessment of additionality" version 03 (Figure B.2 below) for the above purpose, which is applied to the project activity.

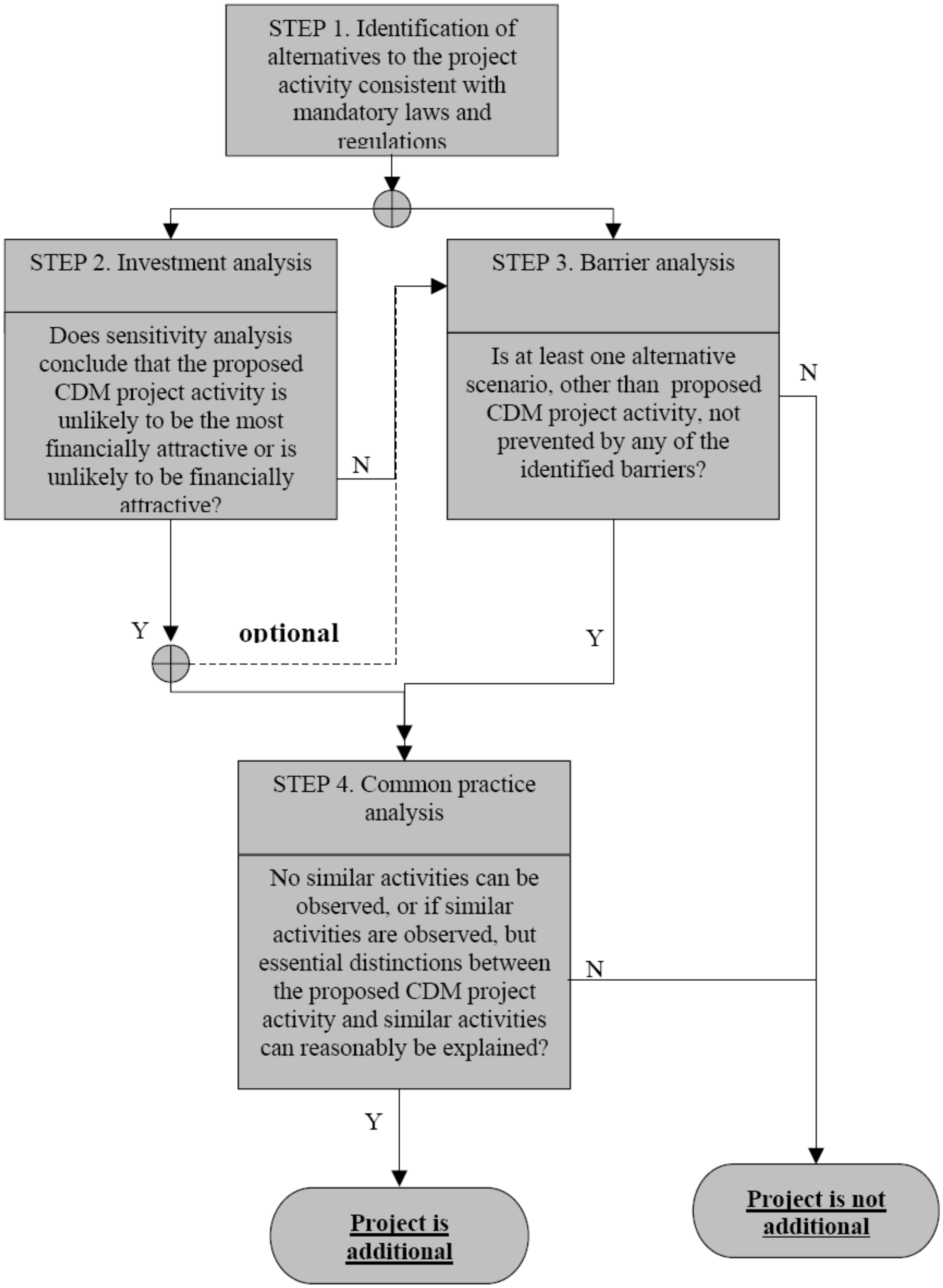

Figure B.2: Steps in the additionality tool

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

Project participants have determined the most plausible baseline scenario among all realistic and credible alternatives separately regarding:

- How power would be generated in the absence of the CDM project activity
- What would happen to the biomass in the absence of the project activity
- In case of cogeneration projects: how heat would be generated in the absence of the project activity

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

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

BASL identified the different potential alternative(s) to the project activity available to all other sugar-manufacturing units in the region. The alternatives have been analysed using (step 3 of the "Tool for demonstration and assessment of Additionality") and the most plausible baseline scenario has been identified in Section B.4.

The alternatives identified are:

Baseline Alternative 1 (BA1):

Combination of P1, H1 and B4. This alternative would involve:

- Implementation of the project activity not undertaken as a CDM project activity
- Installation of a high pressure 67 ata 20 MW cogeneration system
- The existing 67 ata 16 MW biomass residue fired power plant would continue operating.
- The additional heat and power requirements due to the sugar plant capacity expansion would be met by the 20 MW system and the surplus power would be exported to the grid

Baseline Alternative 2 (BA2):

Combination of P4, P6, H4, B1 and B4. This alternative would involve:

- Continuation of the existing biomass residue fired systems using the same type of biomass residues as in the project activity

- A low pressure boiler to meet the additional process steam requirements of the sugar plant capacity expansion
- The additional power requirements due to the sugar plant capacity expansion would be met by the existing biomass power plant. The surplus after meeting the total captive power requirements would be exported to the grid.
- Surplus bagasse would be dumped or left to decay

Sub-step 1b: Consistency with mandatory laws and regulations:

Both the above two alternatives are consistent with applicable laws and regulations:

- Both the above two alternatives are consistent with applicable laws and regulations:
- The applicable regulations do not restrict BASL to continue steam and power generation in the existing pre-project systems.
- The applicable regulations do not restrict BASL to continue steam and power generation from bagasse or other biomass residues and to dump the surplus bagasse.
- Though the Ministry of Non-Conventional Energy Sources (MNES) aims to achieve 10% of installed power generation capacity from renewable sources, there is no mandate on any private entity to enhance power generation capacity from renewable sources.

The next step as per the "Tool for the demonstration and assessment of additionality" is either step 2 or step 3. Step 3 (Barrier analysis) is used for this project activity.

STEP 3 - BARRIER ANALYSIS

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

- Prevent the implementation of this type of project activity; and
- Do not prevent the implementation of at least one of the alternatives

The above study has been done by means of the following sub-steps:

Sub-step 3.a: Identification of barriers that would prevent the implementation of the project activity

Technological Barrier – Performance uncertainties:

The project activity involves a high-pressure co-generation technology (67 ata pressure). During conceptualising the project activity, this technology of high pressure and temperature configuration was of very low penetration in the sugar sector. The performance and success of this technology was yet to be established. The design, construction and operation of a high pressure cogeneration system are significantly different from that of a low pressure system. At high operating pressures, boiler metallurgy (the ability to withstand thermal and mechanical stress) and water chemistry assume critical importance. The sustained performance and operational life of a cogeneration power plant depends on various factors like thermal stress pattern (cyclical loading), quality of water, steam parameters, cooling water parameters and proper operation and maintenance. A high pressure system is more sensitive to these factors than a low pressure system thus increasing the risk of performance loss and equipment damage.

We were mainly sceptical about the performance uncertainties with respect to efficiencies of major equipment, life, trouble-free plant operation and robustness of the technology. This apprehension was due to our unpleasant past experience with similar technology and its low prevalence in the region.

- ***Past experience with similar technology:***

Our past experience with a similar system (16 MW TG and 80 TPH boiler) installed at the project site was not pleasant; we faced persistent technical problems. Since commissioning (in March 2000), the system has been facing several recurring technical problems leading to shutdowns and significant revenue loss. The major problems faced are:

1. Scaling of Turbine internals
2. Load hunting

3. High gear box vibrations
4. Boiler tubes erosion
5. Furnace puffing

Out of the above problems scaling of turbine internals was more serious in nature. This was intimated to the equipment supplier, M/s BHEL, through our letter dated 28.11.2000 (submitted to DOE). BHEL after inspection informed us that the turbine steam flow path requires cleaning as the it got salted, through their letter dated 11.12.2000 (submitted to DOE). BHEL orally informed that this de-scaling activity can be completed within a week. Therefore, as we were not able to load the machine beyond 12 to 13 MW, it was decided to de-scale the turbine internals at the earliest. Accordingly the turbine was stopped and over haul work started on 18.01.2001 (Fax message of BHEL dated 25.01.2001). The over haul of TG, instead of one week, took nearly one month **(27 days – 10% of total working days).** Refer minutes of meeting made along with BHEL Commissioning Engineer (submitted to DOE). The turbine was re-commissioned on 11.02.2001 after completing the over haul.

The financial impact of this is as given below:

- Permitted power export to KPTCL from the TG= 13.25 MW
- Total power export lost due to shutdown = 13.25 MW x 24 Hrs x 27 days X 85% PLF = 7,298,000 kWh.
- Financial loss = 7,298,000 x INR 2.80 / kWh = INR 20.4 Million

The above problems left a negative impact about the technology on our Management. It was felt that the high pressure technology was not yet proven successfully.

Considering the technical problems encountered in the existing high pressure system[7], it is unlikely that our management would have opted to implement a similar system without a performance guarantee or contingency arrangement.

During its conceptualization in 1998, although the existing 16 MW system faced similar technological barriers, the additional financial incentive from MNES (as interest subsidy) encouraged us to take a positive decision to proceed further with the 16 MW system. Such financial incentive from MNES was not available to the 20 MW project activity Also at the time of investment decision of this 20 MW project activity, the power purchase policy was uncertain and not favorable. In such a situation, without any additional incentive and considering the recurring technical problems faced in the existing 16 MW system, it is unlikely that our management would have implemented a similar project activity in the business as usual scenario.

- ***Low prevalence***

During the conceptualization of the project activity in the year 2002, the following similar high pressure cogeneration systems existed in the region:

S.No	Name	Starting Date	Remarks
1	Godawari Sugar Mills Ltd.	April 2002	Gets a higher purchase tariff as per MNES guidelines. Registered as a CDM project.
2	Shri Prabhulingeswara Sugar Works Ltd.	December 2000	Gets a higher purchase tariff as per MNES guidelines
3	Shamanur Sugars	August 1999	Gets a higher purchase tariff as per MNES guidelines
4	Bannari Amman Sugars Limited, Nanjangud	March 2000	Gets a higher purchase tariff as per MNES guidelines

The above data is based on the below survey;

- The list of grid connected sugar cogeneration systems in Karnataka existing at the time of conceptualization were identified from Karnataka Renewable Energy Development Limited (KREDL) website (KREDL website – submitted to DOE)
- Primary data collection from all these plants were done to identify the configuration details of these plants (Analysis of cogeneration systems in the region – submitted to DOE)

As indicated above, only 3 out of 46 sugar mills in the region had implemented the high pressure technology apart from us, all of which enjoy a higher purchase tariff[8] than the project activity. At such nascent stages of any new technology penetration and practical application, it is normal for unexpected

[7] Similar problems continue to persist in the system at presently also.

problems to surface, which would be corrected by the equipment supplier in the later systems by upgrading the design parameters.

As the operating pressure increases, even minor fluctuations in water/steam properties could cause dramatic effects on the performance and life of the boiler and TG. The equipment materials have to be designed to withstand the thermal stress expected as a result of high temperature and pressure differentials. A high pressure system is more sensitive to these factors than a low pressure system thus increasing the risk of performance loss and equipment damage.

Any performance loss or frequent maintenance shutdowns would correspondingly reduce the power and steam output. We were wary that such a situation would not only impact the energy sale revenue but also affect the primary manufacturing process.

This uncertainty in the performance of the high pressure system acted as a deterrent for us to opt for it, which was further emphasized by our unpleasant experience with similar technology.

Materialization of the risk:

It may be noted that our apprehensions have unfortunately materialized for our project activity, in the form of persistent technical problems.

- ***Persistent technical problems***

Since commissioning, the TG has been facing steam leakage problem leading to frequent shutdowns and load limitations resulting in significant revenue losses.

Details of technical problems faced by the project TG is as follows:

S.No	**Date**	**Nature of problem**	**Remarks**
1	24.08.2004	Steam leakage from TG observed. The equipment supplier BHEL's personnel inspected the system.	Minutes of Meeting (MoM) with BHEL dated 24.08.2004
2	03.10.2004 to 27.10.2004	Steam leakage from TG casing rectification work – *1st attempt* ***Shutdown for 24 days***	MoM with BHEL dated 02.11.2004
3	09.12.2004	Steam leakage from TG observed again	Letter No - BAS / K / BHEL /

[8] Refer Proceedings of the Government of Karnataka, page 2, paragraph 1 submitted to DOE

			383 / 2004
4	10.03.2005 to 12.04.2005	BHEL Engineers attended the Turbine steam leakage problem – 2nd *attempt* ***Shutdown for 30 days***	MoM dated 13.04.2005
5	05.09.2005	Fire accident due to oil leakage	Lr. No. BAS/K/CO-GEN/ 9231 /05
6	27.12.2005	Steam leakage observed again. Information given to BHEL.	Lr. No. BAS/K/CO-GEN/ 9337 /05
7	28.01.2006	Bearing vibration problem started	Lr. No. BAS/K/CO-GEN/ 9365 /06
8	04.02.2006	Informed our apprehension to BHEL that the oil leakage appears to be serious in nature. This may result in any major fire accident again. Requested BHEL to depute their Engineer to site to take note of the condition and to advice us.	Lr. No. BAS/K/CO-GEN/ 9372 /06
9	18.02.2006	Engineer from BHEL visited our site and advised us to carryout the spectrum analysis.	MoM with BHEL
10	05.06.06 to 07.07.06	BHEL Engineers attended the Turbine problems again - ***3rd attempt***	MoM dated 15.07.2006
Note: The above table provides only a summary and is not exhaustive. Additional information may be furnished if required.			

It may be noted from the above that since commissioning, the project TG has been facing recurring problems resulting in frequent shutdowns, loading limitations and maintenance expenditures.

The actual revenue loss from the technical problems faced in the 16 MW system had been partly offset by the MNES interest subsidy. However, the actual revenue loss incurred by the technical problems faced so far in the 20 MW project activity has not been recovered yet. Further, the uncertainties in the tariff fixation has resulted in the project activity not receiving any payments till date for the power exported as a result of appeals pending with the Karnataka Electricity Regulatory Commission (KERC) regarding the applicable tariff for the project activity (Refer Letter dated 20.6.2008 from KERC to the State power distribution company that receives power from the project activity).

We believe that our investment decision relying on CDM was right and the same would help us offset the revenue loss due to technical problems. The above is reinstated further through our pursuit of CDM right from the initial stages, involving significant amount of our time, efforts and additional expenses.

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 already considered in step 3a):

***Technological barrier**:*

The baseline alternative 2 (BA2) involves the continuation of the existing plants (which is well established). Thus there are no additional risks due to technology failure or problems in this alternative.

The next step as per Figure B.2 is Step 4: Common practice analysis

Step 4: Common Practice Analysis

Sub-step (4a): Analyse other activities similar to the project activity

The common practice scenario as tabulated below in Table B.1 substantiates that the alternative of implementing the project activity without CDM benefits is not a preferred proposition for the sugar manufacturing units in similar socio-economic environment of Karnataka State. The low pressure boiler and turbine configuration (cogeneration unit to meet the plant's energy requirements) is the most common practice adopted by the sugar- manufacturing units. The Indian sugar manufacturers have been utilising their bagasse in an inefficient manner by using low-pressure boiler (with low electrical and thermal energy efficiency) to generate steam and electricity only for in-house consumption. In the similar project sector, socio-economic environment, geographic conditions and technological circumstances the project activity uses an efficient technology, which is not a common practice.

Before the project activity was implemented there very few sugar mills in the state of Karnataka out of 46 sugar mills, operating with grid connected cogeneration unit of high-pressure configuration of 67 ata (equivalent configuration as of project activity).

Table B1: Common Practice Analysis for BASL project activity

Total number of Sugar Mills in Karnataka	*46*
Cooperative Sugar Mills	*21*
Sugar Mills under private sector	*22*
Sugar Mills under joint sector	*3*
Sugar Mills with co-generation and export of power to grid	*10*
Sugar Mills with similar or better configuration as of BASL at the time of implementation (September 2002) in State	*6*
Sugar Mills with similar or better configuration as of BASL at the time of implementation (September 2002) in the State (Without CDM funding and excluding BASL)	*3 Nos.*[9] *or 6.5%*
Source: Karnataka Renewable Energy Development Limited (KREDL) and Primary Data Collection by BASL	

The above data shows a very low penetration of the high pressure technology (6.5%) in the state of Karnataka.

Sub-step (4b): Discuss any similar options that are occurring

The analysis in sub-step 4a above shows that similar project activities are not widely observed and not commonly carried out in the region and therefore it may be stated that the project activity is not a common practice. In addition, the other three similar project activities in the state enjoy higher power purchase rate[10] than that of BASL project activity that make them more financially robust than that of the project activity.

Since all the criteria of the "Tool for the demonstration and assessment of additionality" are satisfied, the project may be considered additional.

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[9] BASL's survey of the sugar plants in the region

[10] The Power Purchase Agreements (PPAs) of the other three similar project activities were signed much earlier than that of BASL project activity allowing them to enjoy a purchase tariff as per MNES guidelines (Rs.2.25 per kWh with 5% escalation from the base year 1994-95). However, the PPA of BASL project activity was signed later with a lower purchase tariff (Rs.2.80 per kWh with 2% escalation per year). As per the above two different purchase terms, the tariff for 2003-04 is Rs.3.49 for the other three similar project activities whereas it is Rs.2.80 for BASL project activity.

Explanation of CDM Consideration and commencement of CDM process:

Awareness and consideration of CDM:

- During December 2000, we had the opportunity to gain detailed knowledge about the carbon trading concept during a seminar on "Business opportunities in Bagasse based Cogeneration" organized by the Confederation of Indian Industries (CII), USAID[11] and WII[12]. The contact person for this project activity (Mr.R. Murugesan) attended the seminar and has been spearheading the CDM process (Seminar invitation and delegate pass indicating name of person submitted to DOE)
- The concept of CDM and its benefits was also elaborated by our power plant engineering consultant during the project feasibility assessment. The same is reflected in their Detailed Project Report (DPR) prepared in May 2002 (Extracts from the DPR submitted to DOE)
- Our Board of Directors, in their meeting on the 24th June 2002, took into account the benefits of CDM while deciding on the project implementation. Copy of the Board Meeting Minutes book is submitted to DOE.

Starting date of the project activity:

- The Letter of Intent (LoI) for the purchase of the project equipments was placed on 14 September 2002 and subsequently the Purchase Order (PO) was placed on 30 May 2003. Since the decision to implement and real action started with the issuance of LoI, the same is considered as the starting date for the project activity.

Commencement of the CDM process:

The CDM process was initiated by us immediately upon starting the project activity without any delay. This is justified by the following facts:

- The CDM consultant was appointed by us on 21 March 2003 (Copy of work order and bank cheque for advance fee payment submitted to DOE). This is before the date of purchase order of the project equipments.

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[11] United States Agency for International Development

[12] Winrock International India

- The first DOE for validation was appointed on 06 December 2003 (Letter from first DOE on receipt of work order submitted to DOE).
- The Project Design Document (PDD) was prepared and the application for obtaining the Host Country Approval (HCA) was submitted to the Designated National Authority (DNA) in January 2004.
- The meeting with the DNA took place on 31 March 2004 and subsequently the HCA was received on 11 May 2004[13] (Refer HCA).

Delay in commencement of Validation process:

Though the PDD was prepared and submitted to the DNA in January 2004 and a DOE was appointed in December 2003, the Validation could not be commenced immediately due to the following facts:

- A suitable approved CDM methodology was not available.
- In September 2003, our CDM consultants submitted a new methodology for grid connected renewable energy projects, NM0030, though for a different project activity[14] worked by them. We awaited the approval of this methodology for completing the PDD and commencing the Validation process.
- In September 2004, the Meth Panel recommended not to approve NM0030-rev. Though AM0015 was approved at the same time, it could not be applied to our project due to constraints in applicability conditions[15]. Subsequently, we awaited the approval of a similar methodology, NM0050, submitted in April 2004 for another project activity, which was in consideration by the Meth Panel.
- Though this methodology got approved as ACM0006 V1 in September 2005, it was applicable only to projects with back-pressure turbines. Once ACM0006 V2 was approved in March 2006, the PDD was submitted for Validation and web-hosted in April 2006[16], 3 years and 6 months after the starting date.

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[13] Please note that a revised HCA was issued later (on 28 Feb 2005) as per the DNA's new format, which is uploaded by the DOE with the registration request.

[14] NM0030 was submitted for the bagasse co-generation project activity implemented by Balrampur Chinni Mills Limited, which was also worked by our CDM consultant.

[15] AM0015 stated that the plant should use only bagasse generated in-house. However, the project activity may have to run on purchased biomass residues or fossil fuels during emergencies like drought.

[16] http://cdm.unfccc.int/Projects/Validation/DB/VVEZ3K7B2YZCLIP7TJUR4MB2O6GJWX/view.html

- However, on account of delays during the validation process, the validation was reassigned to a DOE with more experience in the sector (at that point in time). The project was web-hosted again in June 2007[17] applying ACM0006 V4.

It may be clear from the above facts that we have taken into account the CDM while deciding to implement the project activity. Further, we initiated the CDM process immediately after starting the project activity, by appointing the CDM consultant and subsequently the DOE for Validation. However methodological and procedural issues have resulted in the delay of our CDM process.

[17] http://cdm.unfccc.int/Projects/Validation/DB/BM7LIROCMQ5KSEGLIJBTU23DB7Y8YK/view.html

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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This section elaborates on the formula used to calculate the project emissions, baseline emissions, leakage and net emission reductions based on ACM0006 and also indicate the choices made in applying the formula.

As defined in section B.4 and B.5 above, the baseline alternative 2 is the most likely baseline scenario which is a combination of options P4&P6, H4 and B4&B1. This corresponds to scenario 16 of ACM0006 version 04 and therefore, for this project activity, the formula applicable to baseline scenario 16 would be used.

B.6.1.1 Project Emissions:

With reference to ACM0006, it is required to account CO_2 emissions from the combustion of fossil fuels used by the project activity (during unavailability of bagasse / drought / any other unforeseen circumstances), from transportation of biomass from other sites to the project activity, CO_2 emissions from electricity consumption and CH_4 emissions from biomass combustion if included in the project boundary. Such emissions are calculated by using the below equations:

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} \cdot PE_{Biomass,CH4,y}$$

Where:

PET_y	CO_2 emissions during the year y due to transportation of the biomass residues to the project plant (tCO_2/yr)
$PEFF_y$	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 (tCO_2/yr)
$PE_{EC,y}$	CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity (tCO_2/yr)
GWP_{CH4}	Global Warming Potential for methane valid for the relevant commitment period
$PE_{Biomass,CH4,y}$	CH_4 emissions from the combustion of biomass residues during the year y (tCH_4/yr). This is not applicable to this project activity as it is excluded from the project boundary both for the calculation of baseline emissions and project emissions.

Carbon dioxide emissions from transportation of biomass to the project site (*PETy*):

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \times AVD_y \times EF_{Km,CO_2,y}$$

Where:

$BF_{k,y}$	is the quantity of biomass type k, transported from other sites and used as fuel in the project plant during the year *y* in a volume or mass unit,
TLy	is the average truck load of the trucks used measured in tons of biomass,
AVDy	is the average return trip distance between the biomass fuel supply sites and the site of the project plant in kilometres (km), and
$EF_{km,CO2,y}$	is the average CO_2 emission factor for the trucks measured during the year y (tCO_2/km)

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

The proper and efficient operation of the biomass residue fired power plant may require using some fossil fuels, e.g. for start-ups or for stabilising combustion (when the moisture content in biomass residue is too high) or on-site transportation of the biomass residues. In addition, any other fuel consumption at the project site that is attributable to the project activity should be taken into account (e.g. for mechanical preparation of the biomass residues).

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

$$PEFF_y = \sum (FF_{project\ plant,i,y} + FF_{project\ site,i,y}) x\ NCV_i\ x\ EF_{CO2,FF,i} \quad \text{.......(1)}$$

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 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 unit per year). Fossil fuel combustion in standby DG sets during start-up or maintenance

activities would only be part of this parameter. Only that fossil fuel consumption attributable to the power capacity expansion would be included in this parameter.

NCV_i	Net calorific value of fossil fuel type *i* (GJ /mass unit)
$EF_{CO2,i}$	CO_2 emission factor for fossil fuel type *i* (tCO_2/GJ)

Carbon Dioxide emissions from electricity consumption ($PE_{EC,y}$)

Any electricity consumption at the project site attributable to the project activity, excluding that of the power plant auxiliary[18] equipments, would be part of this parameter. The possible scenario of electricity consumption as a result of the project activity is the use of captive DG power during project plant maintenance. However, since the captive diesel consumption would be monitored as part of the "Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$)", this need not be again included in this parameter. Since all electricity consumption scenarios are already accounted, this parameter need not be monitored separately.

Methane emissions from combustion of biomass residues ($PE_{Biomass,CH4,y}$)

These emissions are not included in the project boundary and are neglected both in project emissions and baseline emissions.

B.6.1.2 Emission reductions due to displacement of electricity:

Emission reductions due to the displacement of electricity is calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{electricity,y}$), as follows:

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

Where:

$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year *y* (tCO_2/yr)

[18] Auxiliary consumption would be deducted from gross energy generation. Only the net generation is considered in calculating baseline emissions.

EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year *y* (MWh)
$EF_{electricity,y}$	CO_2 emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2/MWh)

Determination of EG_y:

ACM0006 states that where scenario 16 applies, *EGy* corresponds to the lower value between:

(a) The net quantity of electricity generated in the new power unit that is installed as part of the project activity

And

(b) The difference between the total net electricity generation from firing the same type(s) of biomass at the project site (*EGtotal,y*) and the historical generation of the existing power unit(s) (*EGhistoric,3yr*), based on the three most recent years.

The formula is as follows:

$$EG_y = \mathrm{MIN}\left\{\begin{matrix} EG_{project\ plant,\ y} \\ EG_{total,\ y} - \dfrac{EG_{historic,3\ yr}}{3} \end{matrix}\right\}$$

Where:

EGy	is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation n) during the year *y* in MWh,
$EG_{total,y}$	is the net quantity of electricity generated in all power units at the project site, generated from firing the same type of biomass as in the project plant, including the new power unit installed as part of the project activity and any previously existing units, during the year y in MWh.

$EG_{historic,\ 3yr}$ is the net quantity of electricity generated during the most recent three years in all power plants at the project site, generated from firing the same type(s) of biomass as used in the project plant, in MWh.$EG_{project\ plant,y}$ is the net quantity of electricity generated in the project plant during the year y in MWh.**Determination of electricity baseline emission factor (EF_y):**

ACM0006 recommends that if the power generation capacity of the biomass power plant is more than 15 MW, $EF_{electricity,y}$ 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 emission factor is determined in the following three steps:

As prescribed by ACM0002, combined margin emission factor of the grid is calculated as follows:

$$\mathbf{BEF_y = w_{OM}.EF_{OM,\,y} + w_{BM}.EF_{BM\,,\,y}}$$

Where,

w_{OM}	Weight of the operating margin emission factor (0.5 default value as per ACM0002)
$EF_{OM,\,y}$	Operating margin emission factor calculated as per ACM0002
w_{BM}	Weight of the build margin emission factor (0.5 default value as per ACM0002)
$EF_{BM,y}$	Build margin emission factor calculated as per ACM0002
BEF_y	Combined margin baseline emission factor of the grid

Operating margin (OM):

ACM0002 provides four options for calculating OM. Option (a) "Simple OM" has been adopted here and the formula for calculating same is described below:

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

where,

$F_{i,j,y}$	Is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
j	Refers to the power sources delivering electricity to the grid, excluding low-operating cost and must-run power plants, and including imports from the grid
$COEF_{i,j\,y}$	Is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$	Is the electricity (MWh) delivered to the grid by source *j*

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_{i,}\ x\ EF_{CO2} x OXIDi$$

For calculations, local values of NCV_i and $EFCO_{2i}$ from Central Electricity Authority (CEA) reports have been used. The *ex-ante* data vintage of 3-year average, based on the most recent statistics available at the time of PDD submission has been used for the calculation. CEA data for years 2004-05, 2005-06 and 2006-07 are used for the calculations. Refer Annex 3 for details.

Build Margin:

The build margin is calculated as the weighted average emissions of recent capacity additions to the reference grid, based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The PDD has adopted *ex-ante* option for build margin calculation.

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

where,

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

The sample group *m* consists of,

- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Central Electricity Authority (CEA) of India has published a CO_2 baseline database for the regional grids of India. The database includes operating margin, build margin and combined margin emission factors for the regional grids calculated in accordance with the above formula as prescribed by ACM0002. For this project activity, the combined margin baseline emission factor value for the southern regional grid has been directly adopted from the CEA database (Refer Annex 3 for details). The combined margin emission factor as per CEA database is shown below:

$EF_{OM,y}$ = 1.003 tCO_2/MWh

$EF_{BM,y}$ = 0.705 tCO_2/MWh

$EF_{CM,y}$ = 0.85 tCO_2/MWh

B.6.1.3 Emission reductions due to displacement of heat:

In the case of cogeneration plants, project participants shall determine the emission reductions or increases due to displacement of heat ($ER_{heat,y}$). For scenario 16, the emission reductions from the saving of fossil fuels are determined as follows:

$$ER_{heat,y} = \frac{Q_y * EF_{CO2,BL,heat,i}}{\varepsilon_{boiler}}$$

Where,

Q_y is the quantity of heat generated that displaces heat generation in fossil fuel fired boilers

ε_{boiler} is the efficiency of the boiler that would be used in the absence of the project activity

$EF_{CO2,BL,heat,i}$ is the CO_2 emission factor of the fuel type that would be used in the absence of the project activity for heat generation.

In BASL case, the baseline is not a fossil fuel based boiler. The baseline fuel for heat generation would be biomass residues whose CO_2 emission factor is zero. Applying this in the above equation gives,
$ER_{heat,y} = 0$.

<u>B.6.1.4: Leakage:</u>

As defined by ACM0006, the main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion due to diversion of biomass from other uses to the project plant as a result of the project activity. In this case, the project activity is not likely to result in any such increased fossil fuel consumption elsewhere during the crediting period. This would be demonstrated using the option L3 of ACM0006 as described below:

Option L3:

1. *"Demonstrate that suppliers of biomass in the region of the project activity are not able to sell all of their biomass residues. For this purpose, project participants shall demonstrate that the ultimate supplier of the biomass residues and a representative sample of suppliers in the region had a surplus of biomass residues, which they could not sell and which is not utilized"*

The biomass types used in the project activity are mainly agricultural residues that would have been left to decay if not purchased for combustion in the project activity. During verification, BASL would provide proof from the biomass suppliers in the region that they had surplus biomass which could not be sold.

If for a certain type of biomass *k* used in the project activity, leakage effects cannot be ruled out with one of the approaches above, leakage effects for the year *y* shall be calculated (according to ACM0006 formula for scenario 16) as follows:

$$L_y = EF_{co2,LE}.\sum_k BF_{PJ,k,y}.NCV_k$$

where:

Ly	are the leakage emissions during the year y in tons of CO_2
$EF_{CO2,LE}$	is the CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)
$BF_{PJ,k,y}$	is the incremental quantity of biomass residue type k used as a result of the project activity in the project plant during the year y (tons of dry matter)
k	are the types of biomass for which leakage effects could not be ruled out with one of the approaches L1, L2 or L3
NCV_k	is the net calorific value of the biomass type k (GJ/ton).

B.6.1.5: Net Emission reductions

The project activity mainly reduces CO_2 emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass residues. The emission reduction ER_y 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 if included in the project boundary, baseline emissions due to natural decay or burning of biomass residues ($BE_{biomass,y}$) as follows:

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

Where:

ER_y	Emissions reductions of the project activity during the year *y* (tCO_2/yr)

$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
$ER_{heat,y}$	Emission reductions due to displacement of heat during the year y (tCO_2/yr). This parameter is equal to zero for this project activity as described in section B.6.1.3 above.
$BE_{biomass}$	Baseline emissions due to biomass decay. This parameter is excluded from the project boundary and therefore is equal to zero.
PE_y	Project emissions during the year y (tCO_2/yr)
L_y	Leakage emissions during the year y (tCO_2/yr).

Since $ER_{heat,y} = 0$ and $BE_{biomass,y} = 0$ for this project activity, the above equation reduces to:

$$ER_y = ER_{electricity,y} - PE_y - L_y$$

Data uncertainties in GHG emission reduction calculation:

Data uncertainties in the monitored records of the variable parameters could affect the GHG emission reduction estimation. Procedures to prevent data uncertainties and to adjust for data uncertainties are provided for each of the parameters in Annex 4 of the PDD. These procedures would ensure the conservative estimation of emission reductions.

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

Data / Parameter:	$EG_{historic, 3yr}$
Data unit:	MWh
Description:	Energy Generation in all the existing power plants at the project site in the most recent three years prior to the project activity using the same type of biomass residues as in the project plant
Source of data used:	BASL on-site energy meters
Value applied:	345,999.59 MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity was implemented in year 2004. As prescribed by ACM0006, the sum of energy generated by all the power plants at the site during years 2001, 2002 and 2003 has been considered.
Any comment:	

$Q_{historic,3yr}$ is not mentioned here since heat generation is using only biomass residues both in the pre-project and project scenario. As described in section B.6.1.3, there would be no increase or decrease in emissions due to displacement of heat generation (ER_{heat} = 0).

B.6.3 Ex-ante calculation of emission reductions:

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The following tables show the calculation of emission reductions using the formula mentioned in section B.6.1.

Project emissions:

Emissions due to combustion of fossil fuels in the project activity:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	$FF_{project\ plant,i,y}$	Quantity of fossil fuel type 'i' used in project plant	T/yr	0	Minor quantity of coal is likely to be co-fired during emergencies like high moisture content in bagasse. This would be monitored as and when used. No uncertainties in this parameter.
2	$FF_{project\ site,i,y}$	Quantity of fossil fuel type 'i' used onsite	T/yr	0	Fossil fuel combustion in DG sets during start-up or maintenance activities and vehicles used in feeding biomass will be included in this parameter. No other fossil fuel combustion is included in this parameter. Only that fossil fuel consumption attributable to the project activity is included in this

					parameter. Uncertainties for this parameter are addressed above.
3	$NCV_{,i}$	Calorific Value	TJ/T fossil fuel	0	Will be measured when used. Envisaged only during emergencies. No uncertainties in this parameter.
4	$EF_{CO2,FF,i}$	CO_2 emission factor	tCO_2/TJ	0	IPCC default value for the specific fuel used would be adopted. No uncertainties in this parameter.
5	$PEFF_y$ ((1+2)*3*4)	CO_2 emissions	tCO_2/yr	0	Methodology formula.

Emissions due to combustion of fossil fuels for transportation of biomass:					
6	$BF_{,i,y}$	Quantity of biomass type 'i' bought and transported from outside for off-season operation	T	0	Outside biomass purchase not expected since sufficient captive bagasse is available. Outside biomass purchased only during emergencies like drought. No uncertainties in this parameter.
7	TL_y	Average truck load of the trucks used	T	10	Average rated tonnage of trucks used. No uncertainties in this parameter.
8	AVD_y	Average return trip distance between the biomass fuel supply sites and the project plant	kms	100	Conservative assumption. ACM0006 prescribes a minimum value of 20 kms.
9		Truck fuel economy for 10 tonne truck	Kms/litre of fuel	4	Data from local truck operator.
10		Truck fuel economy	Litres/000 'kms	250	Based on above data (1000/4 = 250)
11		Density of diesel	Kg/litre of fuel	0.85	Bureau of Energy Efficiency, India, reference material.
11		Fuel consumption per 1000 kilometer for 10 tonne truck	kg/000'kms	212.5	Based on above parameters (250 X 0.85 = 212.5). No uncertainties in this parameter.
12		CO_2 emission factor	$kgCO_2/kg$ fuel	3.16	IPCC 2006 guidelines default value for diesel.
13	$EF_{km,CO2}$ (11*12)	Average CO_2 emission factor of	$kgCO_2/km$	0.6478	Methodology formula. Refer section B.6.1.1 above.

		the trucks			
14	PET_y ((6*8*13) / (7))	CO_2 emissions from diesel	tCO_2	0	Methodology formula. Refer section B.6.1.1 above.
15	PE_y (5+14)	Total Project Emissions	tCO_2	0	Methodology formula. Refer section B.6.1.1 above.

Leakage:

Emissions due to combustion of fossil fuels due to diversion of biomass from other project activities:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	$BF_{PJ,k,y}$	Incremental quantity of biomass residue type k used as a result of the project activity in the project plant for which leakage effects cannot be ruled out.	T	0	No leakage is envisaged. However, absence of leakage will be proved every year using one of the options L1, L2 or L3. No uncertainties in this parameter.
2	NCV_k	Net calorific value of the biomass type k (per volume or mass).	GJ/T	-	Calorific value of the fuel for which leakage cannot be ruled out will be measured. No uncertainties in this parameter
3	$EF_{CO2,LEj}$	CO_2 emission factor of the most carbon intensive fuel used in the country	tCO_2/GJ	-	This will be determined from the most recently published national data. No uncertainties in this parameter
4	L_y (3). ∑(1) *(2)	Leakage	tCO_2	0	Methodology formula

Emission Reductions due to displacement of electricity:

Determination of EGy:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Remarks**
1	$EG_{project\ plant,y}$	Generation from the 20 MW, 67 ata system in year y	MWhe	108,528	Based on 19 MW generation for 280 days operation at 85% plant load factor (PLF)
2	$EG_{total,y}$	Total Generation from all power plants at the project site in year y	MWhe	200,226	Based on 290 days operation at 85% PLF of the existing plants
3	$EG_{historic,3yr}$	Total Generation from all power plants at the project site during the three most recent years prior to project implementation	MWhe	345,999	Total generation from all plants in years 2001, 2002 and 2003
4	$(EG_{historic,3yr})/3$	Three year average of total generation from all power plants at the site	MWhe/yr	115,333	Methodology Formula
5	$[EG_{total,y}$ - $(EG_{historic,3yr})/3]$ i.e., [(2) – (4)]	Difference between total energy generation in the project scenario and average total generation in three year prior to the project	MWhe	84,893	Methodology Formula
6	EG_y Minimum value between (1) and (5)	Incremental Energy generation from the project activity	MWh	84,893	Methodology Formula
7	$EF_{electricity}$	Baseline emission factor for grid	tCO_2/MWh	0.85	Refer Annex 3

8	$ER_{electricity}$ (6)*(7)	Emission Reduction due to displacement of electricity	tCO_2	72,158	Methodology Formula

Emission reductions

S.No	Notation	Parameter	Unit	Value
1	$ER_{electricity,y}$	Emission Reductions due to displacement of electricity	tCO_2/yr	72,158
2	PE_y	Project emissions	tCO_2/yr	0
3	L_y	Leakage	tCO_2/yr	0
4	ER_y (1-2-3)	Emission reductions	tCO_2/yr	72,158

There are no uncertainties in the estimation of emission reductions as all the critical values used are based on actual data.

For detailed calculations, please refer excel sheets enclosed as appendix to this PDD.

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

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Sr. No.	Operating Years	Electricity Emission reductions BEy	Project Emissions PEy	Leakage Ly	Certified Emission Reductions - CERs
		(tonnes of CO_2)	(tonnes of CO_2)	(tonnes of CO_2)	(tonnes of CO_2)
1.	2008 – 09	72,158	0	0	72,158
2.	2009 – 10	72,158	0	0	72,158
3.	2010 – 11	72,158	0	0	72,158
4.	2011 – 12	72,158	0	0	72,158
5.	2012 – 13	72,158	0	0	72,158
6.	2013 – 14	72,158	0	0	72,158
7.	2014 – 15	72,158	0	0	72,158
8.	2015 – 16	72,158	0	0	72,158
9.	2016 – 17	72,158	0	0	72,158
10.	2017 – 18	72,158	0	0	72,158
	Total	721,580	0	0	721,580

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$BF_{k,y}$**
Data unit:	Tonnes of dry matter
Description:	Quantity of biomass type *k* combusted in the project plant during year y
Source of data to be used:	ACM0006 recommends "on-site measurements using weight or volume meters". Bagasse generated in-house is monitored based on on-site measurement of parameters in weight and volume meters as described below in "Description of measurement methods". Recorded in log books.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	319,755.1 (Based on 19 MW power generation for 280 days and a plant load factor of 90%)
Description of measurement methods and procedures to be applied:	"Bagasse combusted = Bagasse generated + Opening stock - Closing stock in bagasse yard" Bagasse generated = Cane crush + Water added – Juice produced Cane crush is monitored by weigh bridge. Water added and juice produced is monitored through flow meters. The above method of monitoring is an approved method of monitoring for sugar industries and is used in preparing the Monthly and Annual manufacturing reports (RT 7c and 8c) that are submitted to the Government of India. Frequency of monitoring: Daily
QA/QC procedures to be applied:	Monitored bagasse data would be cross-checked with RT 8c and 7c reports of the plant. Annual bagasse balance would be prepared to cross-check recorded data. Conflict of interest: No conflict of interest in conservative data monitoring. Overestimation of emission reductions is likely if the quantity of biomass consumed is recorded as less than actually consumed since project plant efficiency would increase. There is no other benefit to the promoter by doing so. Further any such mis-recording can be identified in the annual mass balance or comparison with historic efficiency.
Any comment:	

Data / Parameter:	**Moisture content of the biomass**
Data unit:	Tonnes
Description:	Moisture content of biomass type *k* combusted
Source of data to be	Lab chemist log book

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50% for bagasse
Description of measurement methods and procedures to be applied:	Weights method – The weight of bagasse with moisture and without moisture (after drying in oven) is measured to arrive at the moisture content Frequency of monitoring: Daily
QA/QC procedures to be applied:	Equipments used like mass balances would be calibrated periodically. Conflict of interest: No conflict of interest in conservative data monitoring. Overestimation of emission reductions is likely if the moisture content of biomass consumed is recorded as more than actually consumed since project plant efficiency would increase. There is no other benefit to the promoter by doing so. Further any such mis-recording can be identified in the annual mass balance or comparison with historic data.
Any comment:	

Data / Parameter:	**AVD_y**
Data unit:	Kilometres (Kms)
Description:	Average return trip distance between biomass fuel supply sites and the project site in case of purchased biomass.
Source of data to be used:	Records by BASL on the origin of the biomass – Will be recorded in biomass purchase log books based on information provided by truck operators.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100
Description of measurement methods and procedures to be applied:	The truck operator will provide the distance travelled by the truck between the fuel supply site and the project activity. Frequency of monitoring: Continuously
QA/QC procedures to be applied:	Consistency of distance records provided by the truckers will be checked by comparing recorded distances with information from other sources. No potential conflict of interest in conservative data monitoring since truck operators would not provide a lower distance as it will reduce their revenue.
Any comment:	This data is used to calculate project emissions from biomass transportation

Data / Parameter:	**TL_y**
Data unit:	Tonnes
Description:	Average truck load of the trucks used for transportation of biomass
Source of data to be used:	Measured in BASL weigh bridge and recorded in log books
Value of data applied	10

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Determined by averaging the weights of each truck carrying biomass to the project plant Frequency of monitoring: Continuously, aggregated annually
QA/QC procedures to be applied:	Weigh bridges used for measuring the truck loads will be calibrated periodically
Any comment:	This data is used to calculate project emissions from biomass transportation

Data / Parameter:	**$EF_{km, CO2,y}$**
Data unit:	t CO_2/km
Description:	Average CO_2 emission factor for transportation of biomass with trucks
Source of data to be used:	Sample measurements of the fuel type, fuel consumption and distance traveled for all truck types. Calculate CO_2 emissions from fuel consumption by multiplying with appropriate net calorific values and CO_2 emission factors. For net calorific values and CO_2 emission factors, reliable national default values or, if not available, (country-specific) IPCC default values would be used.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.6478
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	Cross-check measurement results with literature
Any comment:	

Data / Parameter:	**$EF_{CO2,FF, i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for fossil fuel type i
Source of data to be used:	Measurement results – Third party reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- (Actual value would be monitored based on type of fossil fuel used)

Description of measurement methods and procedures to be applied:	Analysis of samples of specific fossil fuel used would be conducted at reputed laboratories once in six months whenever fossil fuel is used.
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:	

Data / Parameter:	**$FF_{project\ plant\ i,y}$**
Data unit:	Tonnes
Description:	Onsite fossil fuel consumption of type 'i' for co-firing in the project plant
Source of data to be used:	BASL boiler fuel log books
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- (Not expected during normal operation. Actual value would be monitored)
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel is measured at the BASL weigh bridge before their unloading into the project site. [Fuel combusted = Opening stock - Closing stock + Fuel purchase if any for the day] Recording Frequency: Daily Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock exchanges. No potential conflict of interest in conservative data monitoring as no other type of benefit is available for recording a lower quantity of fossil fuel consumption than actually consumed.
Any comment:	

Data / Parameter:	**$FF_{project\ site\ i,y}$**
Data unit:	Tonnes
Description:	Onsite fossil fuel consumption of type 'i' other than co-firing attributable to the project activity. Fossil fuel combustion in standby DG sets during start-up or maintenance activities and vehicles used in feeding biomass will only be included in this parameter. Only that fossil fuel consumption attributable to the project activity would be included in this parameter.
Source of data to be used:	BASL fuel consumption log books
Value of data applied	- (Actual value would be monitored)

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel is measured in volume or weight meters. Monitoring frequency: Continuously.
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock exchanges. No potential conflict of interest in conservative data monitoring as no other type of benefit is available for recording a lower quantity of fossil fuel consumption than actually consumed.
Any comment:	

Data / Parameter:	**Steam diverted**
Data unit:	Tonnes
Description:	Quantity of steam diverted from other boilers to the project plant
Source of data to be used:	BASL steam flow meters
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:	Measured in steam flow meters Recording Frequency: Continuously Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	Periodic calibration of the flow meters. The consistency of metered net heat generation of the project boiler would be cross checked with the quantity of biomass fired to see if it results in a reasonable efficiency
Any comment:	Minimal quantity of steam from the adjacent 80 TPH boiler may be diverted to the project activity. Measured in steam flow meters.

Data / Parameter:	**Efficiency**
Data unit:	MWh/MWh (Energy of steam generated expressed in MWh per MWh of Energy input as fuel)
Description:	Average net efficiency of steam generation in the plant from which steam is diverted to the project plant
Source of data to be used:	Data from BASL steam and fuel log books to be used for calculation
Value of data applied for the purpose of	- (No steam diversion from other plants likely. This parameter will be calculated when such diversion occurs)

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Calculated by dividing the steam generation by the sum of fuels used, both expressed in MWh. Recording Frequency: Annually Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	The consistency will be checked with manufacturer's information
Any comment:	

Data / Parameter:	**$EG_{project\ plant,y}$**
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in the project plant during year y
Source of data to be used:	BASL Energy meter log books
Value of data applied for the purpose of calculating expected emission reductions in section B.5	114,912
Description of measurement methods and procedures to be applied:	The data will be recorded in log books on a daily basis based on energy meters of BASL. Monitoring frequency: Continuously
QA/QC procedures to be applied:	The energy meters will be calibrated periodically. The consistency of the recorded net electricity generation will be cross-checked with receipts from energy sales and the quantity of fuel fired (e.g. check whether the electricity generation divided by the quantity of fuel fired results in a reasonable efficiency that is comparable to previous years) No potential conflict of interest in conservative data recording.
Any comment:	Net electricity will be arrived as the difference between gross electricity generation and auxiliary consumption

Data / Parameter:	**$EG_{total,y}$**
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in all power generating units in year y
Source of data to be used:	BASL Energy meter log books
Value of data applied for the purpose of calculating expected emission reductions in	212,004

section B.5	
Description of measurement methods and procedures to be applied:	The data will be recorded in log books on a daily basis based on energy meters of BASL. Monitoring Frequency: Continuously
QA/QC procedures to be applied:	The energy meters will be calibrated periodically. The consistency of metered net electricity generation will be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years)
Any comment:	The fraction of electricity generated from firing biomass residues should be determined by dividing the relevant quantity of biomass residues by the total quantity of all fuels fired, both expressed in energy quantities. Net electricity will be arrived as the difference between gross electricity generation and auxiliary consumption.

Data / Parameter:	**$NCV_{i,FF}$**
Data unit:	GJ/T
Description:	Net calorific value of fossil fuel type i
Source of data to be used:	Analysis reports of reputed third party agency
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15.7 (Based on average CEA calorific value of 3755 kcal/kg for coal in the latest annual review report available)
Description of measurement methods and procedures to be applied:	Samples of the fossil fuel will be sent to a reputed third party agency. The NCV is determined in calorimeters of a reputed third party agency. Monitoring Frequency: Once in six months
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:	The value will be monitored when fossil fuel is used

Data / Parameter:	**NCV_k**
Data unit:	GJ/T
Description:	Net calorific value of biomass residue type k during year y
Source of data to be used:	Analysis reports of reputed third party agency
Value of data applied for the purpose of calculating expected	7.00 (For bagasse based on a gross calorific value of 2200 kcal/kg with 50% moisture)

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Samples of the fuel will be sent to a reputed third party agency. The NCV is determined in calorimeters of a reputed third party agency. Monitoring Frequency: Once in six months
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:	

Data / Parameter:	**Surplus biomass in the region**
Data unit:	Tonnes
Description:	Quantity of biomass residue of type k (that could not be sold or is not utilized) at the ultimate supplier to the project and a representative sample group of suppliers in a geographic region of 100 kms.
Source of data to be used:	Surveys by BASL among the biomass suppliers or other reliable sources.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	315,560
Description of measurement methods and procedures to be applied:	Data will be collected from regional biomass suppliers / KREDL Monitoring Frequency: Annually
QA/QC procedures to be applied:	-
Any comment:	Option L3 is used to rule out leakage as per ACM0006

Data / Parameter:	$\mathbf{EF_{CO2,LE}}$
Data unit:	tCO_2/GJ
Description:	CO2 emission factor of the most carbon intensive fuel in the country
Source of data to be used:	Central Electricity Authority (CEA) published values and IPCC default value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0961 (Based on CEA Calorific value for coal of 15.7 GJ/T and IPCC default emission factor of 96.1 tCO_2/TJ)
Description of measurement methods and procedures to be applied:	Will be calculated using Calorific value of fuels from CEA reports Monitoring Frequency: Annually

QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

Project proponent will form a CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in the section B.7.1 above. In the CDM team, a special group of operators will be formed who will be assigned responsibility of monitoring of different parameters and record keeping as per the monitoring plan. On daily basis, the monitoring reports will be checked and discussed by the senior CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it will be informed to the concerned person for necessary actions. On monthly basis, these reports will be forwarded at the management level. Detailed monitoring plan including procedures for performance management and training of monitoring personnel are provided in Annex 4.

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)

>>

Date of completing the final draft of this baseline section:

25/09/2008

Name of person/entity determining the baseline:

M/s. Bannari Amman Sugars Limited

1212, Trichy Road

Coimbatore

Tamilnadu - 641018

The entity is a project participant listed in Annex 1 to this 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:

>>
14/09/2002

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

>>
20 years 0 months

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

For the proposed project, a fixed crediting period of 10 years has been chosen.

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:

>>

27/10/2008 or upon Registration with UNFCCC whichever is later. The project promoter confirms that the crediting period would not be commenced prior to registration of the project activity.

C.2.2.2. Length:

>>

10 years 0 months

SECTION D. Environmental impacts

>>

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

>>

A Rapid Environmental Impact Assessment (REIA) and an Environmental Management Plan (EMP) has been done for the project activity. A summary of these reports are provided as Enclosure – I to this document. The assessment of environmental impact due to the project activity has been carried out to understand if there are any significant environmental impacts and a management plan has been prepared to minimise adverse environmental impact. The study indicates that the impacts of the project are not significant.

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

>>

The relevant legislations regarding the environmental impact of a project activity are:

- The EIA notification of 1994 and its further amendments
  The project activity does not fall under the purview of this notification
- Air (Prevention and Control of Pollution) Act, 1981 (Central Act 14 of 1981) as amended
- The project activity falls under the purview of this Act under which a "No Objection Certificate" or "Consent to Establish" is to be obtained from the Karnataka State Pollution Control Board (KSPCB). BASL has obtained this clearance and it is being submitted to the DOE.
- Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended.
- The project activity falls under the purview of this Act under which a "No Objection Certificate" or "Consent to Establish" is to be obtained from the Karnataka State Pollution Control Board (KSPCB). BASL has obtained this clearance and it is being submitted to the DOE.
- As required by the KPSCB, an EIA and EMP has been prepared and submitted to them.

SECTION E. Stakeholders' comments

>>

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

>>

Identification of Stakeholders

Bannari Amman Sugars Limited (BASL) conducted a local stakeholder consultation process during the construction of the project activity. BASL identified the local stakeholders likely to be affected by the project activity. A meeting of all the stakeholders was organised and individual invitations were mailed in advance to each of the stakeholders indicating the date, time and venue of the meeting.

The stakeholders identified for the project activity are as under:

1. Elected body of representatives administering the local area (village Panchayat)
2. Local cane growers' association
3. Local residents and farmers
4. Karnataka Pollution Control Board (KPCB)
5. Karnataka Power Transmission Corporation Limited (KPTCL)

Stakeholder consultation:

The stakeholders' meeting was held on 26/03/2003 by BASL at the sugar factory premises. Representatives of BASL briefed them about the CDM project activity and salient features of the project including its GHG reduction potential. The stakeholders discussed about the project activity and raised queries to which BASL replied. During the end of the meeting, the stakeholders provided their written responses which are being submitted to the DOE.

E.2. Summary of the comments received:

>>

Stakeholders' comments:

Local panchayat

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, their consent / permission to set up the project is necessary. BASL has already completed the necessary consultation and documented their approval for the project activity. Copy of Panchayat clearance is being submitted to the DOE. The query raised by the Head – Panchayat and response given by BASL is provided below:

Query: *"How is the power supply situation in the area improved by the project activity?"*

BASL response: *"The project is located in a rural setting away from large power plants.The de-centralization of power generation results in improving the power quality. Prior to the project activity, the household supply voltage in the region was low and Fluorescent lamps , agricultural pumps and household appliances failed to start. Now, with the load end location of the BASL power plant, the supply voltage has improved considerably enabling the good operation of electrical appliances. Moreover, the power deficit in the region would also be reduced to a large extent by export of around 23 MW BASL's power plant."*

Local farmers and residents

Local population comprises of mainly farmers in and around the project area. The comments from the President of the local cane growers' association and farmers in the area have been documented. They have appreciated BASL for implementing the project activity and no negative comments were received.

Karnataka State Pollution Control Board (KPCB)

The project activity has received No Objection Certificate (NOC) from the KPCB and Consent to establish the plant under Section 21 of the Air (Prevention and Control of Pollution) Act 1981 as amended. KPCB in their consent has prescribed stack heights for the cogeneration plant boiler. KSPCB has also prescribed standards of environmental compliance for the stack emissions from the cogeneration plant. BASL would have to periodically monitor the stack emissions to ensure compliance with standards. The project activity has also received consent to operate for the discharge of sewage trade effluent under Section 25/26 of the Water (Prevention and Control of Pollution, Central Act 6 of 1974) as amended. The KPCB has laid out special conditions to be followed by the cogeneration plant for effluent discharge to ensure compliance with environmental standards. KPCB has also laid out maximum daily effluent discharge limits for the cogeneration plant effluents.

Karnataka Power Transmission Corporation Limited (KPTCL)

As a buyer of the power, the KPTCL is a major stakeholder in the project activity. They hold the key to the commercial success of the project. KPTCL has already cleared the project and BASL has already signed Power Purchase Agreement (PPA) with KPTCL.

There are no negative comments whatsoever from the stakeholders on the implementation of the project activity; rather all the stakeholders have encouraged the upcoming of the same.

All the stakeholders were happy in knowing that a CDM project activity in their locality is contributing to a global cause and they commended the BASL management for their initiatives in the areas of climate change and sustainable development. The stakeholders lauded the project promoter for the environment friendly measures. The written responses are being submitted to the DOE.

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

>>

All stakeholders have appreciated BASL's project activity and there were no negative comments from any of the stakeholders concerned. However, some of the stakeholder's comments and BASL response are provided below:

Query (by panchayat): *"How is the power supply situation in the area improved by the project activity?"*

BASL response: *"The project is located in a rural setting away from large power plants. The de-centralization of power generation results in improving the power quality. Prior to the project activity, the household supply voltage in the region was low and Fluorescent lamp , agricultural pumps and household appliances failed to start. Now, with the load end location of the BASL power plant, the supply voltage has improved considerably enabling the good operation of electrical appliances. Moreover, the power deficit in the region would also be reduced to a large extent by export of around 23 MW BASL's power plant."*

KPCB requirements and BASL action:

KPCB in their consent has prescribed stack heights for the cogeneration plant boiler. KSPCB has also prescribed standards of environmental compliance for the stack emissions from the cogeneration plant. BASL has established stack of required height and other pollution control equipment. They are also periodically monitoring the stack emissions and are in compliance with applicable standards.

The KPCB has laid out norms to be followed by the cogeneration plant for effluent discharge to ensure compliance with environmental standards. BASL has established the necessary treatment facilities and the effluent discharge is within the prescribed limits.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Bannari Amman Sugars Limited
Street/P.O.Box:	1212, Trichy Road
Building:	Bannari Amman Sugars Limited
City:	Coimbatore
State/Region:	Tamilnadu
Postfix/ZIP:	641018
Country:	India
Telephone:	91-422-2305454
FAX:	91-422-2305454
E-Mail:	finance@bannari.com
URL:	www.bannari.com
Represented by:	
Title:	Vice President (Finance)
Salutation:	Mr.
Last Name:	R
Middle Name:	
First Name:	Murugesan
Department:	Finance
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	rmurugesan@bannari.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding available for this project activity

Annex 3

BASELINE INFORMATION

The Central Electricity Authority (CEA) has published the baseline emission factors database for the various electricity grids in India. The emission factors have been calculated based on UNFCCC guidelines (based on ACM0002). For further details on the calculation methods and data used, please refer the following web-link:

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

In the CEA database, the simple operating margin, build margin and combined margin emission factors of the regional electricity grids have been provided separately for two cases; Including electricity imports and Excluding electricity imports from other regional grids. Since, emission factors excluding imports are lower, the same has been considered as a conservative approach. The combined margin emission factor for the southern regional grid (0.85 tCO_2/MWh) has been considered for this project activity.

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**3.0**
DATE	**15 December 2007**
BASELINE METHODOLOGY	**ACM0002**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.72	0.73	0.74	0.71	0.71	0.71	0.72
East	1.09	1.06	1.11	1.10	1.08	1.08	1.03
South	0.73	0.75	0.82	0.84	0.78	0.74	0.72
West	0.90	0.92	0.90	0.90	0.92	0.87	0.85
North-East	0.42	0.41	0.40	0.43	0.32	0.33	0.39
India	0.82	0.83	0.85	0.85	0.84	0.82	0.80

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.98	0.98	1.00	0.99	0.97	0.99	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16	1.13
South	1.02	1.00	1.01	1.00	1.00	1.01	1.00
West	0.98	1.01	0.98	0.99	1.01	0.99	0.99
North-East	0.74	0.71	0.74	0.74	0.71	0.70	0.69
India	1.02	1.02	1.02	1.03	1.03	1.02	1.01

Build Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North					0.53	0.60	0.63
East					0.90	0.97	0.93
South					0.70	0.71	0.71
West					0.77	0.63	0.59
North-East					0.15	0.15	0.23
India					0.69	0.68	0.68

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.76	0.76	0.77	0.76	0.75	0.80	0.81
East	1.06	1.06	1.05	1.07	1.05	1.06	1.03
South	0.86	0.85	0.86	0.85	0.85	0.86	0.85
West	0.87	0.89	0.88	0.88	0.89	0.81	0.79
North-East	0.44	0.43	0.44	0.44	0.43	0.42	0.46
India	0.86	0.86	0.86	0.86	0.86	0.85	0.85

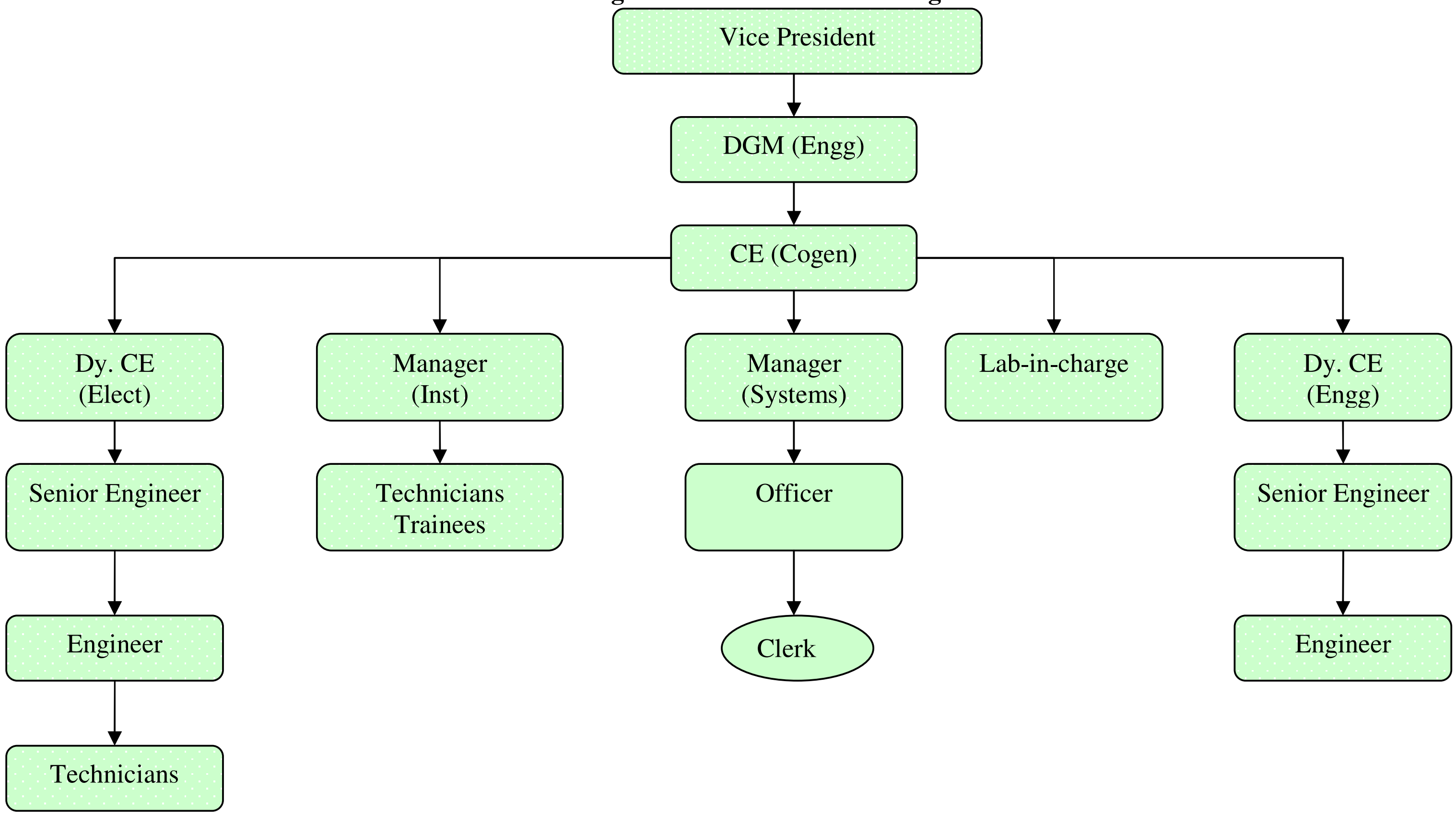
Annex 4

MONITORING INFORMATION
Description of the Monitoring Plan

CDM TEAM:

The CDM team comprises of personnel from the Engineering, Electrical, Instrumentation, Laboratory and Systems departments. The personnel in the team perform the dual functions of power plant O&M and compliance with CDM procedures. The organization structure of the CDM team is given in Figure below.

Organization structure showing the CDM Team



Parameters to be monitored and detailed monitoring procedures:

$EG_{Project\ Plant,gross}$ - Gross energy generation of the project plant (MWh)	
Monitoring methods and procedures	This data will be measured continuously in BASL energy meters. The Technician (Electrical) will record the generation data on a daily basis in log books.
QA/QC procedures	A monthly energy balance will be prepared to cross-check the recorded generation data with other parameters. In case the deviation in recorded data is beyond the allowable limits for the energy meter used, the meter will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". Periodic calibration and maintenance of the energy meter will be arranged by the Electrical department.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost • Delay in calibrating the energy meter – In some years, the period between two calibrations may be more than one year due to unavoidable circumstances like extended crushing season of the

	sugar plant due to which the cogeneration plant cannot be stopped for maintenance. During the above circumstances, the lower value between the below two would be adopted for emission reduction calculations: • Gross generation = Captive consumption + Energy exported + Auxiliary consumption • Gross generation = Heat equivalent of biomass fired X Efficiency of the system calculated with latest reliable data • When the period between two calibrations is more than a year, no adjustments need to be done if the meter error during calibration is within limits. If meter error during calibration is above limits by "x%", then "x%" may be deducted from the monitored data for the non-calibrated period for calculating CERs. As far as possible, the calibration and maintenance of the meters would be scheduled when the plant is under shutdown to avoid any data uncertainties.

$EG_{project\ plant,aux}$ - Auxiliary consumption (MWh)	
Monitoring methods and procedures	This data will be measured continuously in BASL energy meters. The Technician (Electrical) will record the consumption data on a daily basis in log books.
QA/QC procedures	A monthly energy balance will be prepared to cross-check the recorded consumption data with other parameters. In case the deviation in recorded data is beyond the allowable limits for the energy meter used, the meter will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". Periodic calibration and maintenance of the energy meter will be arranged by the Electrical department.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily

	Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost • Delay in calibrating the energy meter – In some years, the period between two calibrations may be more than one year due to unavoidable circumstances like extended crushing season of the sugar plant due to which the cogeneration plant cannot be stopped for maintenance. During the above circumstances, the lower value between the below two would be adopted for emission reduction calculations: • Auxiliary consumption = Gross generation -Captive consumption - Energy exported • Auxiliary consumption = Gross generation X % Auxiliary consumption calculated based on most recent reliable data available • When the period between two calibrations is more than a year, no adjustments need to be done if the meter error during calibration is within limits. If meter error during calibration is above limits by "x%", then "x%" may be deducted from the monitored data for the non-calibrated period for calculating CERs. As far as possible, the calibration and maintenance of the meters would be

	scheduled when the plant is under shutdown to avoid any data uncertainties.

$EG_{Project\ Plant,\ Net}$ - Net energy generation (MWh)	
Monitoring methods and procedures	This data will be measured as the difference between gross generation and auxiliary consumption measured in BASL energy meters.
QA/QC procedures	Since this data is based on monitored Gross generation and auxiliary consumption data, separate QA/QC procedures are not necessary.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	Since this data is based on monitored Gross generation and auxiliary consumption data, separate procedures for data adjustments are not necessary.

$EG_{other\ Plants,gross}$ - Gross energy generation in other power plants at the site (MWh)	
Monitoring methods and procedures	This data will be measured continuously in BASL energy meters. The Technician (Electrical) will record the generation data on a daily basis in log books.
QA/QC procedures	A monthly energy balance will be prepared to cross-check the recorded generation data with other parameters. In case the deviation in recorded data is beyond the allowable limits for the energy meter used, the meter

	will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". Periodic calibration and maintenance of the energy meter will be arranged by the Electrical department.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost • Delay in calibrating the energy meter – In some years, the period between two calibrations may be more than one year due to unavoidable circumstances like extended crushing season of the sugar plant due to which the cogeneration plant cannot be stopped for maintenance. During the above circumstances, the lower value between the below two would be adopted for emission reduction calculations: • Gross generation = Captive consumption + Energy exported + Auxiliary consumption • Gross generation = Heat equivalent of biomass fired X Efficiency of the system calculated with latest reliable data • When the period between two calibrations is more than a year, no

	adjustments need to be done if the meter error during calibration is within limits. If meter error during calibration is above limits by "x%", then "x%" may be deducted from the monitored data for the non-calibrated period for calculating CERs. As far as possible, the calibration and maintenance of the meters would be scheduled when the plant is under shutdown to avoid any data uncertainties.

$EG_{other\ plants,aux}$ - Auxiliary consumption in other power plants at the site (MWh)	
Monitoring methods and procedures	This data will be measured continuously in BASL energy meters. The Technician (Electrical) will record the consumption data on a daily basis in log books.
QA/QC procedures	A monthly energy balance will be prepared to cross-check the recorded consumption data with other parameters. In case the deviation in recorded data is beyond the allowable limits for the energy meter used, the meter will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". Periodic calibration and maintenance of the energy meter will be arranged by the Electrical department.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and	For this parameter, data uncertainties are likely during the following

adjustments	scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost • Delay in calibrating the energy meter – In some years, the period between two calibrations may be more than one year due to unavoidable circumstances like extended crushing season of the sugar plant due to which the cogeneration plant cannot be stopped for maintenance. During the above circumstances, the lower value between the below two would be adopted for emission reduction calculations: • Auxiliary consumption = Gross generation -Captive consumption - Energy exported • Auxiliary consumption = Gross generation X % Auxiliary consumption calculated based on most recent reliable data available • When the period between two calibrations is more than a year, no adjustments need to be done if the meter error during calibration is within limits. If meter error during calibration is above limits by "x%", then "x%" may be deducted from the monitored data for the non-calibrated period for calculating CERs. As far as possible, the calibration and maintenance of the meters would be scheduled when the plant is under shutdown to avoid any data uncertainties.

$EG_{Other\ Plants,\ Net}$ - Net energy generation in other power plants at the site (MWh)	
Monitoring methods and procedures	This data will be measured as the difference between gross generation and auxiliary consumption measured in BASL energy meters.
QA/QC procedures	Since this data is based on monitored Gross generation and auxiliary consumption data, separate QA/QC procedures are not necessary.

Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	Since this data is based on monitored Gross generation and auxiliary consumption data, separate procedures for data adjustments are not necessary.

EG_{Total} - Net energy generation in all power plants at the site (MWh)	
Monitoring methods and procedures	This data will be calculated as the sum of net generation of all power plants at the site.
QA/QC procedures	Since this data is based on monitored Gross generation and auxiliary consumption data, separate QA/QC procedures are not necessary.
Reporting	The total generation data would be part of the Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	Since this data is based on monitored net generation data of all plants, separate procedures for data adjustments are not necessary.

Captive consumption of factory (MWh) – The methodology does not necessitate monitoring of this parameter. However, it is monitored for reference purposes.	
Monitoring methods and procedures	This data will be measured continuously in BASL energy meters. The Technician (Electrical) will record the consumption data on a daily basis in log books.
QA/QC procedures	A monthly energy balance will be prepared to cross-check the recorded consumption data with other parameters. In case the deviation in recorded data is beyond the allowable limits for the energy meter used, the meter will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". Periodic calibration and maintenance of the energy meter will be arranged by the Electrical department.
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost During the above circumstances, the lower value between the below two would be adopted for emission reduction calculations: • Captive consumption = Gross generation -Auxiliary consumption - Energy exported

	• Captive consumption = Cane crushed X Specific power consumption for crushing calculated based on most recent reliable data available

$EG_{Project\ Plant,\ export}$ - Energy exported (MWh) - The methodology does not necessitate monitoring of this parameter. However, it is monitored for reference purposes.	
Monitoring methods and procedures	This data will be measured continuously in KPTCL/CESCOM energy meters located at the switchyard/sub-station. The energy exported would be recorded by KPTCL/CESCOM personnel in the presence of BASL personnel (SEE) on a monthly basis in the Joint meter reading" log book. The Technician (Electrical) also records this data in log books on a daily basis.
QA/QC procedures	The recorded data would be cross-checked with a check meter installed along with the main energy meter. In case the deviation in recorded data is beyond the allowable limits for the energy meters used, the meter will be calibrated/rectified at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments".
Reporting	The Shift Electrical Engineer (SEE) will review and approve the log books on a daily basis and record the data in computer in the form of Daily Cogen Report. The daily report would be reviewed by the Senior Engineer (SE) or Deputy Chief Engineer (Dy.CE) and forwarded to the CE (Cogen) and DGM (Engineering). On a monthly basis, a compilation of all the energy parameters recorded for the month would be prepared by the SE/Dy.CE and submitted to the CE and DGM (Engg).
Data archiving	The CE (Cogen) would verify the daily and monthly energy report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in main meter or check meter • When meter is dismantled for O&M or calibration

	Since there are two meters installed, during any of the above problems in one meter, the other meter would still be working and therefore the recorded data of the other meter will be used for the error period.

Biomass combusted (captive bagasse) – in Tonnes	
Monitoring methods and procedures	This data will be measured as follows: *"Bagasse combusted = Bagasse generated + Opening stock - Closing stock in bagasse yard"* This data is recorded on a daily basis by JE/AE – Engineering in log books. During most crushing season days, the entire quantity of bagasse generated would be directly fed to the boiler. However, during some days, bagasse may partly go to or be taken from the bagasse yard. *Bagasse generated = Cane crush + Water added – Juice* Cane crush is monitored by weigh bridge. Water added and juice are monitored through flow meters. *The above method of monitoring is an approved method of monitoring for sugar industries and is used in preparing the Monthly and Annual manufacturing reports (RT 7c and 8c) that are submitted to the Government of India.*
QA/QC procedures	Monitored bagasse data would be cross-checked with RT 8c and 7c reports of the plant. Annual bagasse balance would be prepared to cross-check recorded data. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments".
Reporting	Bagasse data recorded by JE/AE would be reviewed and input to the computer by the Senior Engineer (SE) – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE (Cogen).
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios:

	• During error in monitored values • Monitored data missing During any of the above scenarios, bagasse quantity would be computed as follows: Bagasse consumed = Gross energy generation / Efficiency calculated using latest reliable data

Biomass combusted (outside biomass) – in Tonnes	
Monitoring methods and procedures	This data will be measured as follows: *"Biomass combusted = Biomass purchased + Opening stock - Closing stock in biomass yard"* This data is recorded on a daily basis by JE/AE – Engineering in log books. Biomass purchased is monitored by weigh bridge. The type of biomass would also be recorded.
QA/QC procedures	Monitored biomass data may be cross-checked with biomass purchase invoices. Calibration of weigh bridge would be done annually. For the period of any error, data would be adjusted as described under "Data uncertainties and adjustments".
Reporting	Biomass data recorded by JE/AE would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in monitored values • Monitored data missing During any of the above scenarios, biomass quantity would be computed as follows:

	Biomass consumed = Gross energy generation / Efficiency calculated using latest reliable data

Moisture content of biomass (%)	
Monitoring methods and procedures	This data will be measured for each type of biomass on a monthly basis by the Lab-in-Charge (LIC) using the "weights method" (Weighing the sample before and after drying in an oven). The LIC records the data in log books.
QA/QC procedures	Mass balance used in the measurement process is calibrated annually.
Reporting	Biomass data recorded by LIC would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • Monitored data missing • Monitoring not done During any of the above scenarios, moisture content would be computed as follows: The least moisture content measured historically for the type of biomass would be considered for that period.

Net Calorific Value of biomass (GJ/ton)	
Monitoring methods and procedures	This data will be monitored for each type of biomass on a quarterly basis by a third party analysis. The Lab-in-Charge (LIC) will be responsible for collecting samples and arranging the analysis.
QA/QC procedures	Not applicable
Reporting	Calorific value data recorded by LIC would be reviewed and input to the

	computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Fossil fuel combusted (co-fired) in the project plant (Tonnes)	
Monitoring methods and procedures	This data will be measured as follows: *"Fossil fuel combusted = Fuel purchased + Opening stock - Closing stock in fuel storage"* This data is recorded on a daily basis by JE/AE – Engineering in log books. Fossil fuel purchased is monitored by weigh bridge.
QA/QC procedures	Monitored fossil fuel data may be cross-checked with purchase invoices. Calibration of weigh bridge would be done annually.
Reporting	Fossil fuel data recorded by JE/AE would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in monitored values • Monitored data missing During any of the above scenarios, the entire quantity of fossil fuel purchased in a particular monitoring period would be considered as combusted in the project plant.

Fossil fuel consumption at the project site (Tonnes)	
Monitoring methods and procedures	Fossil fuel combustion in standby DG sets during start-up or maintenance activities and vehicles used in feeding biomass will only be included in this parameter. This data will be measured in volume measurements as and when supplied to the DG sets or vehicles. This data is recorded on a daily basis by JE/AE – Engineering in log books. Fossil fuel purchased is monitored by weigh bridge.
QA/QC procedures	Monitored fossil fuel data may be cross-checked with purchase invoices. Calibration of weigh bridge would be done annually.
Reporting	Fossil fuel data recorded by JE/AE would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in monitored values • Monitored data missing During any of the above scenarios, the entire quantity of fossil fuel purchased in a particular monitoring period would be considered as combusted in the project plant.

Net Calorific Value of fossil fuel (GJ/Ton)	
Monitoring methods and procedures	This data will be monitored on a quarterly basis by a third party analysis. The Lab-in-Charge (LIC) will be responsible for collecting samples and arranging the analysis.
QA/QC procedures	Not applicable

Reporting	Calorific value data recorded by LIC would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Distance from biomass sites (kms)	
Monitoring methods and procedures	This data will be measured in truck odometers by the truck operators and recorded by the systems department clerk at the weigh bridge. This data is recorded on a continuous basis by the clerk in log books.
QA/QC procedures	Consistency of distance records provided by the truckers will be checked by comparing recorded distances with information from other sources
Reporting	Distance data recorded by clerk would be reviewed and input to the computer by the Officer – Systems. On a monthly basis, a compilation of CDM parameters recorded for the month would be prepared by the Officer and submitted to the Manager – Systems.
Data archiving	The Manager-Systems would verify the monthly CDM report and forward it to the CE for his review and archiving.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • Data missing If data is missing for a particular truck load of biomass, the farthest distance recorded in the past would be assumed.

Truck load (Tonnes)	
Monitoring methods and procedures	This data will be measured in BASL weigh bridge and recorded by the systems department clerk at the weigh bridge.

	This data is recorded on a continuous basis by the clerk in log books.
QA/QC procedures	Weigh bridge would be calibrated annually
Reporting	Truck load data recorded by clerk would be reviewed and input to the computer by the Officer – Systems. On a monthly basis, a compilation of CDM parameters recorded for the month would be prepared by the Officer and submitted to the Manager – Systems.
Data archiving	The Manager-Systems would verify the monthly CDM report and forward it to the CE for his review and archiving.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • Data missing If data is missing for a particular truck load of biomass, the maximum load recorded in the past would be assumed.

Truck mileage (kms/litre)	
Monitoring methods and procedures	This data will be monitored by the transportation operators. Declaration from the biomass transportation operators would be obtained by the stores department on an annual basis for a sample of the trucks used.
QA/QC procedures	Check consistency of measurements and local / national data
Reporting	Truck mileage data obtained would be reviewed by the Systems department Manager and provided to the CE.
Data archiving	The CE would verify the report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Leakage analysis – Biomass availability in the region	
Monitoring methods and procedures	Option L3 of ACM0006 is preferred to be used by the project promoters. Surveys of biomass suppliers (of the same biomass type used in the project plant) in the region will be obtained by the systems department on an

	annual basis. The geographical boundary for this will be a radius of 100 kms.
QA/QC procedures	Check with any local reports if available.
Reporting	Survey results obtained would be submitted to the CE.
Data archiving	The CE would verify the results and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Steam diverted (Tonnes)	
Monitoring methods and procedures	Steam flow meters are used to measure this parameter. Any steam diverted from the other boilers at the site to the project plant (TG) would be measured as the difference in steam flow from the boilers and that inlet to the TG. This would be recorded by the JE/AE (Engg) in log books on a daily basis.
QA/QC procedures	Steam flow meters would be calibrated annually.
Reporting	Steam diverted data recorded by JE/AE would be reviewed and input to the computer by the SE – Engineering. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the SE and submitted to the CE.
Data archiving	The CE would verify the monthly energy-CDM report and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Efficiency of steam generation of the plant from which steam is diverted to the project plant (MWh of steam / MWh of fuel input)	
Monitoring methods and procedures	This is calculated on an annual basis using the total steam generation and fuel input. This would be calculated by the SE (Engg) on an annual basis.
QA/QC procedures	The efficiency would be compared with manufacturer’s information
Reporting	The efficiency data calculated by the SE would be submitted to the Dy.CE

	and CE.
Data archiving	The CE would verify the data and archive it.
Data uncertainties and adjustments	For this parameter, data uncertainties are not likely.

Procedures for project performance reviews before data is submitted for internal audit or external verification:

The CE (Cogen) assisted by the Dy.CE (Electrical) and Dy.CE (Engg) would do the project performance review every month based on the monthly energy reports. A comparison of the daily fuel consumption and energy generation data will be done using MS-Excel. This would reveal the performance of the project activity which would be compared against the expected performance levels. Any discrepancy or deviations would be inspected and traced back to original records and corrective action for that parameter as per the CDM Manual would be done.

Procedures for internal audit and Management review:

An internal audit of the project activity would be done on a half yearly basis during the management review meeting (MRM). The review (audit) team would include at least one technical person and an accounts person. The team would audit the project for the below aspects among other things:

- Are the monitoring of CDM parameters done in line with the CDM PDD and CDM Manual
- Is the documentation of monitored CDM parameters done properly
- Are equipments calibrated and maintained as scheduled
- Is the quantity of CERs generated inline with that projected in the CDM PDD? If not, what are the reasons for deviation?
- Are necessary corrective actions being taken to address deviations?
- Check the authenticity of data monitored and recorded by random cross-checking with other sources.

The audit team would submit their observations to the DGM (Engg) for his review and necessary action. The DGM (Engg) would instruct the CDM Team head (CE – cogen) to take the required corrective action if any suggested by the audit team.

Procedures for corrective actions for better future monitoring and reporting:

Errors or anomalies in the monitoring and reporting would be identified by the CE (Cogen) while reviewing the monthly CDM reports. A comparison of these reports would reveal any data errors or missing data or other anomalies. Errors or deviations will also be identified during the half yearly review/internal audits. The CE would take up these matters during the monthly CDM Team meeting (that normally would happen a few days after monthly CDM reports are prepared and submitted). The root cause of these errors would be discussed and appropriate action would be taken for better future monitoring and reporting. The corrective actions may include:

- Training of monitoring personnel where required
- Replacement or repair of equipment

Procedures for training of monitoring personnel:

- An initial training would be provided by the CDM consultant to all the monitoring personnel identified. Detailed monitoring procedures for each of the CDM parameters would be elaborated.
- Subsequent to the training program, the consultant would witness the actual monitoring on site and help with any difficulties faced by the personnel.
- The CE (CDM – Head) would closely inspect the monitoring activities till the mechanism works smoothly.
- Any new person joining the team would be trained on the job by the person being replaced.

Functions of the CDM Team:

- Monitor parameters for calculating emission reductions generated by the project activity
- Maintain records of relevant data for verification of CERs.
- Ensure accuracy of data by proper maintenance and calibration of monitoring equipment.
- Operate the power plant in compliance with the CDM Project Design Document
- Take all preventive measures to ensure plant availability at all times.

CDM Team meeting:

The team meets once a month to review the CDM performance of the plant. Any particular concerns are discussed and appropriate action is taken.

Appendices

Appendix A

Abbreviations

BASL	Bannari Amman Sugars Limited
CC	Climate Change
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CMIE	Centre for Monitoring Indian Economy
CO	Carbon mono-oxide
CO_2	Carbon di-oxide
CPU	Central Power Units
DCS	Distributed Control System
DPR	Detailed Project Report
DM	De-Mineralised
EGEAS	Electric Generation Expansion Analysis System
EPS	Electric Power Survey
ESP	Electro Static Precipitator
EIA	Environmental Impact Assessment
FYP	Five Year Plan
GHG	Greenhouse Gas
GOI	Government of India
GoK	Government of Karnataka
GWh	Gega Watt hour
HP	High Pressure
HV	High Voltage
IPCC	Intra-governmental Panel for Climate Change
IPP	Independent Power Producers
IREDA	Indian Renewable Energy Development Agency
ISPLAN	Integrated System Plan
KP	Kyoto Protocol
Km	Kilo meters
KV	Kilo Voltage
KW	Kilo Watt
KWh	Kilo Watt hour
KPCL	Karnataka Power Corporation Limited
KPTCL	Karnataka Power Transmission Corporation Limited
KPCB	Karnataka Pollution Control Board
KERC	Karnataka Electricity Regulatory Commission
LP	Low Pressure
1 Lakh	1,00,000
MkWh	Million Kilo Watt hour
MU	Million units or Million kWhs
MNES	Ministry of Non-conventional Energy Sources
MoP	Ministry of Power

MoU	Memorandum of Understanding
MSW	Municipal Solid Waste
MT	Metric Ton
MW	Mega Watt
NCE	Non Conventional Energy
NEDA	Non conventional Energy Development Agency
Nox	Nitrogen Oxides
NTPC	National Thermal Power Corporation
NOC	No Objection Certificate
p.a	Per annum
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PIN	Project Idea Note
REP	Renewable Energy Projects
SEB	State Electricity Board
SO_2	Sulphur Di-oxide
SPM	Solid Particulate Matter
STG	Steam Turbine Generator
TCD	Tones of Crushing per Day
TDS	Total Dissolved Solids
TJ	Trillion Joules
TPH	Tones Per Hour
TERI	Tata Energy Research Institute
UNFCCC	United Nations Framework Convention on Climate Change

Appendix B

Reference List

S.No	Particulars of the references
	Kyoto protocol / UNFCCC Related
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2.	Website of United Nations Framework Convention on Climate Change (UNFCCC), **http://unfccc.int**
3.	UNFCCC Decision 17/CP.7 : Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
4.	UNFCCC , Clean Development Mechanism-Project Design Document (CDM-PDD) version 02(in effect as of: July 01, 2004)
	Project Related
6.	Detailed Project Report on 20 MW Non-Conventional renewable Sources proposed bagasse Cogeneration Power Plant at BASL, Nanjangud,
7.	Various project related information / documents / data received from BASL.
	Baseline and Additionality Related
8.	Website of Central Electricity Authority (CEA), Ministry of Power, Govt. of India - **www.cea.nic.in**
9.	Website of Ministry of Power (MoP), Govt. of India **www.powermin.nic.in**
10.	Website of Ministry of Non-Conventional Energy Sources (MNES), Govt. of India – **www.mnes.nic.in**
11.	Karnataka Renewable Energy Development agency Limited's web site. **http://www.kredl.org**
12.	Official website of Karnataka Electricity Regulatory Commission, **http://www.kerc.org**
13.	Infraline web site. http://www.infraline.org
14.	South India Sugar Manufacturer's Assosiation (SISMA)
15.	www.indianelectricity.com

Appendix C

The energy and mass balances for the two baseline alternatives are described below (also provided in CER calculation excel sheet):

S.No	Parameter	Unit	Project scenario (Baseline alternative 1)	Baseline alternative 2
1	Crushing capacity	TCD	7500	7500
		TCH	312.5	312.5
	Power Demand			
2	Specific power consumption of sugar plant per tonne cane	kWh/T	28	28
3	Power required for rated crushing capacity	MW	8.75	8.75
	Steam Demand			
4	Sugar plant 2.5 ata steam requirement at 40% on cane	TPH	125	125
5	Sugar plant 8 ata steam requirement at 2% on cane	TPH	6.25	6.25
6	Total sugar plant steam requirement	TPH	131.25	131.25
7	Cogen plant 2.5 ata steam requirement at 5% of steam generated	TPH	9.74	8.50
8	Cogen plant 8 ata steam requirement at 10% of steam generated	TPH	19.47	8
9	Total steam requirement at 2.5 ata	TPH	134.6	133.5
10	Total steam requirement at 8 ata	TPH	25.5	14.3
11	Total process steam required	TPH	160.1	147.8
12	Steam to 16 MW TG condenser	TPH	32.0	22.0
13	Total steam requirement	TPH	192.1	169.8
14	Rated steam generation capacity available	TPH	200	80
15	Shortfall (to be met by installing a new 14 ATA steam only boiler)	TPH	-	89.8

	Power Generation			
16	Power generation in 16 MW system	MW	15.5	15.5
17	Power generation in 20 MW system	MW	19	0
18	Power generation (all plants)	MW	34.5	15.5
	Steam Generation			
19	Steam generation in existing 80 TPH 67 ata boiler		72.5	80
20	Steam generation in 120 TPH 67 ata project boiler		120	0
21	Steam generation in new low pressure "heat only" boiler		0	90
	Bagasse			
22	Bagasse % on Cane	%	26.00	26.00
23	Bagasse generated	TPH	81.25	81.25
24	Bagasse consumed in existing 80 TPH 67 ATA boiler	TPH	30.21	33.30
25	Bagasse consumed in 120 TPH 67 ATA project boiler	TPH	50.00	0.00
26	Bagasse consumed in new 14 ATA "heat only" boiler	TPH	0.00	40.91
27	Total bagasse consumption	TPH	80.21	74.21
28	Surplus bagasse saved	TPH	1.04	7.04
29	Season days	days	280.00	280.00
30	Plant Load Factor	%	85.00	85.00
31	Surplus bagasse saved	Tonnes	5940.5	40212.5
	Off-season operation			
32	Power generation (in 16 MW TG)	MW	15.5	15.5
33	Steam generation in 80 TPH 67 ata boiler	TPH	74	74
34	Bagasse consumed in 80 TPH 67 ATA boiler	TPH	29.12	29.12

35	Operating days[19]	days	10	67.7
36	Bagasse consumed in off-season	tonnes	5940.5	40212.5
	Electricity balance			
37	Electricity generation from 16 MW system	MWh	91698.0	109940.3
38	Electricity generation from 20 MW system	MWh	108528.0	0.0
39	Electricity generation (all plants)	MWh	200226.0	109940.3

Please note that the maximum electricity generation possible in the baseline scenario is 109940 MWh, which is less than the 3 year historical average (115333 MWh) considered in the emission reduction estimation. Therefore, the use of historic data results in lesser incremental electricity and therefore lesser emission reductions compared to the baseline scenario data. Thus, the use of historical average emissions for the calculation of emission reductions is conservative.

[19] Since season period is around 280 days and another 15 days required for annual maintenance, a maximum of 70 days of off-season operation is possible. The project plant TG is of extraction back-pressure type and therefore does not have the provision to operate during the off-season

Enclosures

Enclosure I

Report on Environmental Impact

The environmental impacts can be either categorized as primary or secondary impacts. Primary impacts are those that can be attributed directly to the project itself while secondary impacts are those, which are induced indirectly because of the development activity which may be triggered by the primary impact. The secondary impacts typically include the associated investment and changed patterns of social and economic activity by the project activity.

The impact of the project on the environment can occur at two stages:

1. Construction phase
2. Operational phase

The project activity concerned has been set up adjacent to the existing sugar manufacturing unit at Nanjangud.

Impacts during construction phase

The impacts during construction phase due to the construction of the 20 MW bagasse based cogeneration plant are listed as given here:

Air quality impacts:

- Due to particulate emissions from site clearing
- Due to particulate emissions from quarrying operations offsite
- Due to vehicular emissions from transportation of raw materials such as cement, sand, gravel etc
- Due to particulate emissions from construction activities such as pre-casting, fabrication, welding etc

Noise level increase:

- From earth moving equipments used for site clearing
- From quarrying operations offsite
- From transportation of raw materials such as cement, sand, gravel etc
- From construction activities onsite

Land and soil impacts:

- From change/ replacement of existing land-use by site clearing
- From soil erosion due to removal of vegetation
- From solid wastes disposed on land from construction activities

Water environment impacts

- From consumption of water for construction purposes

Impacts on ecology

- Removal of vegetation at the site

Impacts on socioeconomic environment

- Employment opportunities to local people

The above represents a broad range of environmental impacts during the construction phase of the cogeneration plant.

It should be noted that the impacts due to construction activities are mostly short-term and will cease to exist beyond the construction phase.

Impacts during operational phase

The operational phase involves power generation from bagasse. The cogeneration plant feeds surplus power to the grid and indirectly prevents the pollutants otherwise let out into the atmosphere from the thermal power plants (coal, gas and diesel based) of the State grid. Also bagasse being a biomass – renewable fuel does not add any net CO2 to the atmosphere as the carbon gets recycled during cane growth.

Alternative methods of bagasse disposal being currently practiced in sugar plants includes inefficient burning of bagasse in boilers or letting it to decompose, which would lead to more dust and GHG emissions when compared to the present project activity. The impacts during operational phase of the cogeneration plant are as given here:

Air quality impacts:

The cogeneration plant discharges the following pollutants into the air:

- Suspended Particulate Matter (SPM) from fly ash in the flue gas
- Oxides of Nitrogen (NOx) in the flue gas
- Carbon dioxide (CO_2)

The ash content in bagasse is less than 2%. As the pollution control regulations limit the particulate matter emissions from bagasse fired steam generators to 150 mg/ Nm3, electrostatic precipitators (ESP's) are used in the cogeneration plant to contain the dust emission from the plant to less than 150mg/Nm3 during bagasse firing.

The fly ash collected from the ESP hoppers and air heater hoppers and the ash collected from the furnace bottom hoppers are used as landfill during the seasonal operation of the plant when bagasse will be the main fuel. Considering the high potash content in the bagasse, the ash is used as manure.

As there is no sulphur in bagasse, SO2 emissions are not expected. The temperatures encountered in the steam generators while burning high moisture bagasse are low enough not to produce nitrogen oxides. Carbon dioxide produced by firing bagasse is absorbed by sugar cane plantation and hence recycled.

To reduce to ground level air contaminants, a 76 m stack was suggested for baggase-fired boiler. This has helped in faster dispersion of air pollutants into the atmosphere thus reducing the impact on the project surroundings.

The air quality parameters released i.e. SO2, NOx, CO and SPM emissions from the stacks attached to the boiler of the cogeneration plant are to be monitored as per the Section 21 of the Air (Prevention & Control of) Pollution Act 1981.

Noise level increase:

The sound pressure level generated by the noise sources decrease with increasing distance from the source due to wave divergence. Sound attenuation is expected due to atmospheric effects and its interaction with objects in the transmission path

In a cogeneration plant, noise level increase is primarily from:

- Cogeneration plant operation
- Transportation of vehicles carrying the biomass to the cogeneration power plant.

The rotating equipment of the cogeneration plant is designed to operate with a total noise level which will not exceed 85 – 90 db (A) as per the requirement of the Occupational Health and Safety Administration (OSHA) standards. The rotating equipment is provided with silencers wherever required to meet the noise pollution regulations. As per OSHA, the damage risk criteria enforced to reduce hearing loss stipulates that the noise level upto 90 dBA is acceptable for 8 working hours per day.

The green belt has been provided around the plant area for noise attenuation. Also the workers are instructed to wear ear masks to reduce noise level impacts.

Water quality impacts:

The effluents generated from the project activity are being treated in the effluent treatment plant to ensure that there is no environmental deterioration.

The effluents generated from the project activity are as given below:

- Effluent from DM plant: Hydrochloric acid and sodium hydroxide are used as regenerants in the DM water plant for boilers and the acid and alkali effluent are neutralized in an epoxy line neutralizing pits. Generally these effluents are self-neutralizing however, provisions are made such that the effluents are completely neutralized by addition of acid/ alkali. The effluent will then be pumped into the effluent treatment ponds which are a part of the effluent disposal system
- Chlorine in the condenser cooling water is about 0.2 ppm and this value would not result in chemical pollution and meets the national standards for liquid effluent
- The effluent from boiler: The blow down water generated from the boiler would have high pH and temperature from the pollution viewpoint. The effluent is generated at 1.22 TPH having a high pH of 9.8 – 10.3 and temperature of 100 deg C and is disposed into the trench and then through sugar plant effluent ponds
- Sewage from various buildings in the plant are conveyed through separate drains into the septic tank

Wastewater treatment plant has been provided for the adequate treatment of the cogeneration plant effluents. The wastewater is treated to suit its use for irrigation purposes.

The characteristics of effluents from the cogeneration plant are maintained so as to meet the requirements of KPCB and minimum national standards from thermal power plants.

Ecological impacts:

No ecological impacts are envisaged as the wastewaters from the cogeneration plant are treated appropriately before final disposal.

Also as trees have been planted around the plant, it gives a cool atmosphere in the operational area and provide as a barrier for air emissions and noise level increase.

Land and soil impacts:

The solid wastes generated from the cogeneration plant are the dry fly ash and wet bottom ash from Grate. Considering the high potash content in the ash generated from bagasse firing, the same is being used as manure in nearby cane fields. Also since the filter press mud from the sugar plant also has good land nutrient value, ash is mixed with press mud and the same is sold to farmers for use in cane fields.

Socio-economic impacts

The cogeneration plant has contributed to socio economic growth in the following ways;

- Generation of employment to 50 technical experts in various fields like mechanical, electrical, electronics, instrumentation, chemical engineering etc

- Feeding of surplus power to the grid thereby bridging the gap between demand and supply in a power deficit State
- Offering environmentally friendly solution for additional power generation without using fossil fuels
- Improvement of financial position of the sugar plant
- Reduction in fuel transportation costs
- Reduction in transmission losses
- Self reliance of power in rural areas

Environmental Management Plan (EMP)

The EMP is prepared to basically manage the various impacts arising from construction and operational phases of the cogeneration power plant.

Construction phase

Air environment

The following mitigative measures were proposed during construction phase

- Spraying of water at regular intervals to control fugitive dust emissions from construction activities
- Closing materials in trucks with tarpaulin during transportation of raw materials to the site to prevent dust emissions
- Regular and periodic emission check for transportation vehicles
- Use of personal protective equipment (PPE) like goggles and nose masks to reduce impact of dust emissions during construction activities

Noise environment

- Periodic noise control checks on transportation vehicles
- Provision of ear plugs, work rotation, adequate training

Operational phase

Air environment

- Regular and periodic emission check for transportation vehicles
- Use of personal protective equipment (PPE) like goggles and nose masks to reduce impact of dust emissions
- Periodic monitoring of boiler stack emissions

Noise environment

- Periodic noise control checks on vehicles
- Provision of ear plugs, work rotation, adequate training
- Incorporation of noise control measures at source
- Sound proofing/ glass panelling of critical operating stations
- Regular noise level monitoring at the plant and surrounding area
- Plantation of green belt which acts as a attenuator of noise

Land and soil environment

- Improvement of soil quality and plantation of suitable tolerant species in the study area.

Water environment

- Treatment of cogeneration plant effluents in the effluent treatment plant
- Periodic monitoring of water quality parameters

Ecological environment

- Plantation of greenbelt

Socioeconomic Environment

- Training to cane growers and farmers in order to improve productivity

Post project monitoring

- The effluent characteristics are being monitored so as to meet the requirements of the Karnataka Pollution Control Board under the Section 25/26 of the Water (Prevention & Control of) Pollution Act 1974 and the minimum national standards (MINAS) for effluent from thermal power plants
- Air quality monitoring so as to meet the requirements of the Karnataka Pollution Control Board under the Section 21 of the Air (Prevention & Control of) Pollution Act 1971
- The air quality parameters being monitored from the stack emissions are SPM and SO2. A laboratory attached to the cogeneration plant is equipped with necessary instruments for carrying out air quality monitoring.