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 02

30/05/2007

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.

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:

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

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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India

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

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Karnataka

A.4.1.3. City/Town/Community etc:

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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 in Alaganchi Village, Nanjangud Taluk (12.07°N 76.44°E), 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 are available. The geographical location of the project activity is indicated in the diagrams below:

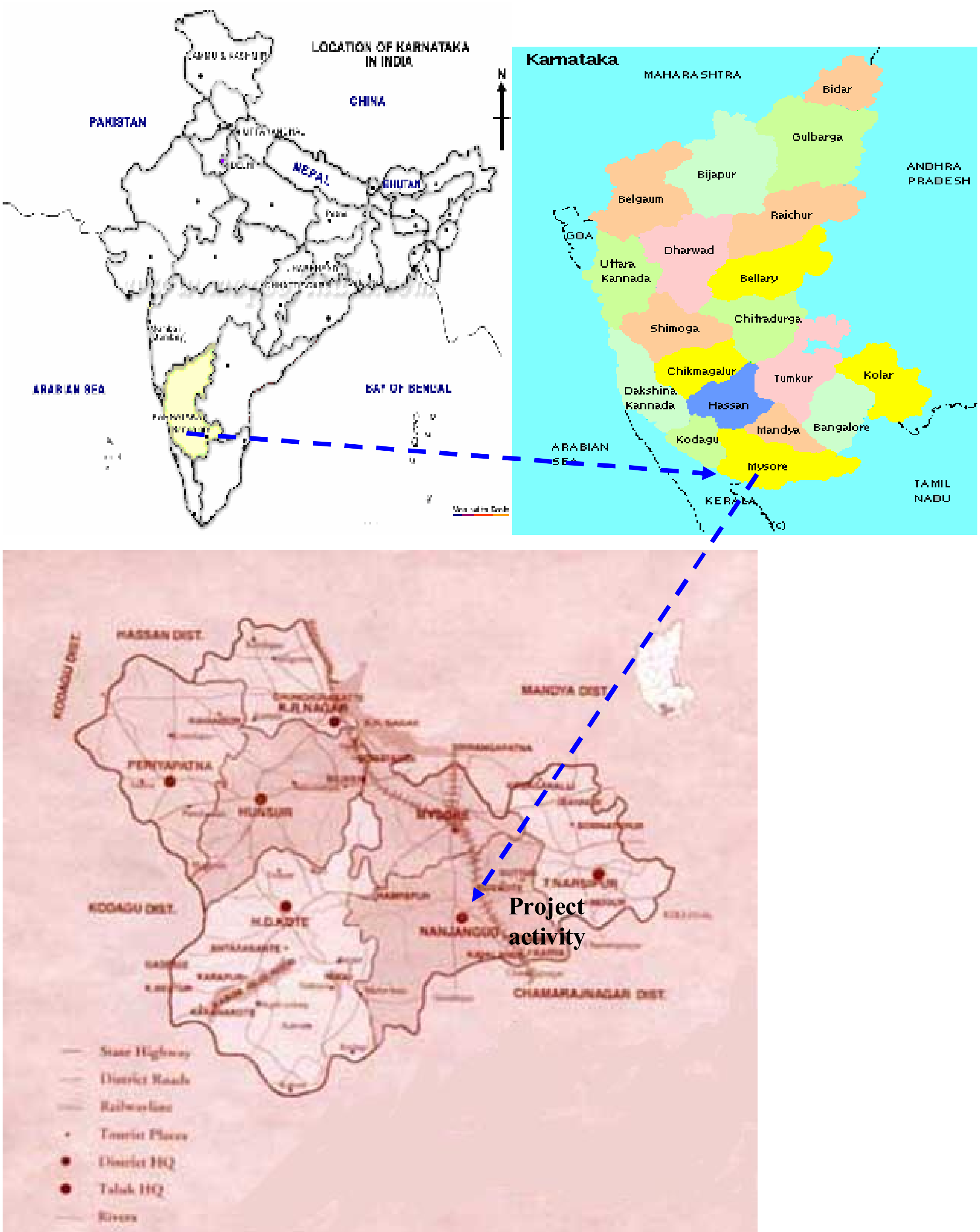

Figure A.1: Location of the project activity

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 cogeneration system and a 7.5 MW, 43 ata system are operating in parallel. The two systems meet the captive energy requirements of the 5000 TCD sugar plant and export a surplus power of 12 MW to the grid.

Baseline Scenario: The sugar plant expansion from 5000 TCD to 7500 TCD is planned. In the business as usual (baseline) scenario, BASL would have planned and met its additional captive energy requirements of the higher capacity from the existing cogeneration systems and a new low pressure heat only boiler, as is common practice in the Indian sugar industry.

CDM project Scenario: The sugar plant expansion from 5000 TCD to 7500 TCD is planned. 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. As planned, the sugar plant capacity expansion was completed in 2004-05. The 20 MW CDM project activity is commissioned in March 2004. The 7.5 MW, 43 ata system is de-commissioned. Parallel operation of the existing 16 MW system and the new 20 MW, 67 ata, cogeneration system. Surplus bagasse generation from the expansion is used in the new 20 MW system. However, cane crushing and thus bagasse generation was below the rated capacity due to reduced cane output as a result of drought. Power export to the grid has increased from 12 MW in the pre-project scenario to 16.5 MW in 2005. From 2007 onwards, full capacity crushing is expected and therefore surplus bagasse quantity available for combustion in the project activity will increase. The total power exported is expected to increase to around 22 MW from 2007 onwards. 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.

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
2007 – 08	73,007
2008 – 09	73,007
2009 – 10	73,007
2010 – 11	73,007
2011 – 12	73,007
2012 – 13	73,007
2013 – 14	73,007
2014 – 15	73,007
2015 – 16	73,007
2016 – 17	73,007
Total estimated reductions (tones of CO_2e)	730,070
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	73,007

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology

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

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Title: Consolidated baseline methodology for grid connected electricity generation from biomass residues, 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)
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.
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 following emission sources are included for determining the GHG emissions of the project activity:

- CO_2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity. This includes fossil fuels co-fired in the project plant, fossil fuels used for on-site transportation or fossil fuels or electricity used for the preparation of the biomass residues, e.g., the operation of shredders or other equipment, as well as any other sources that are attributable to the project activity; and
- CO_2 emissions from off-site transportation of biomass residues that are combusted in the project plant.

For the purpose of determining the baseline, project participants have included the following emission sources:

- CO_2 emissions from fossil fuel fired power plants connected to the electricity system; and
- CO_2 emissions from fossil fuel based heat generation that is displaced through the project activity.

Methane emissions are excluded from both project and baseline emissions,

The spatial extent of the project activity includes:

- Fuel storage and processing area
- Boiler, TG set and all other power generating equipments, captive consumption units, steam consuming equipments and auxiliary equipments.
- The means for transportation of biomass residues to the project site
- All grid connected power plants of the southern regional grid.

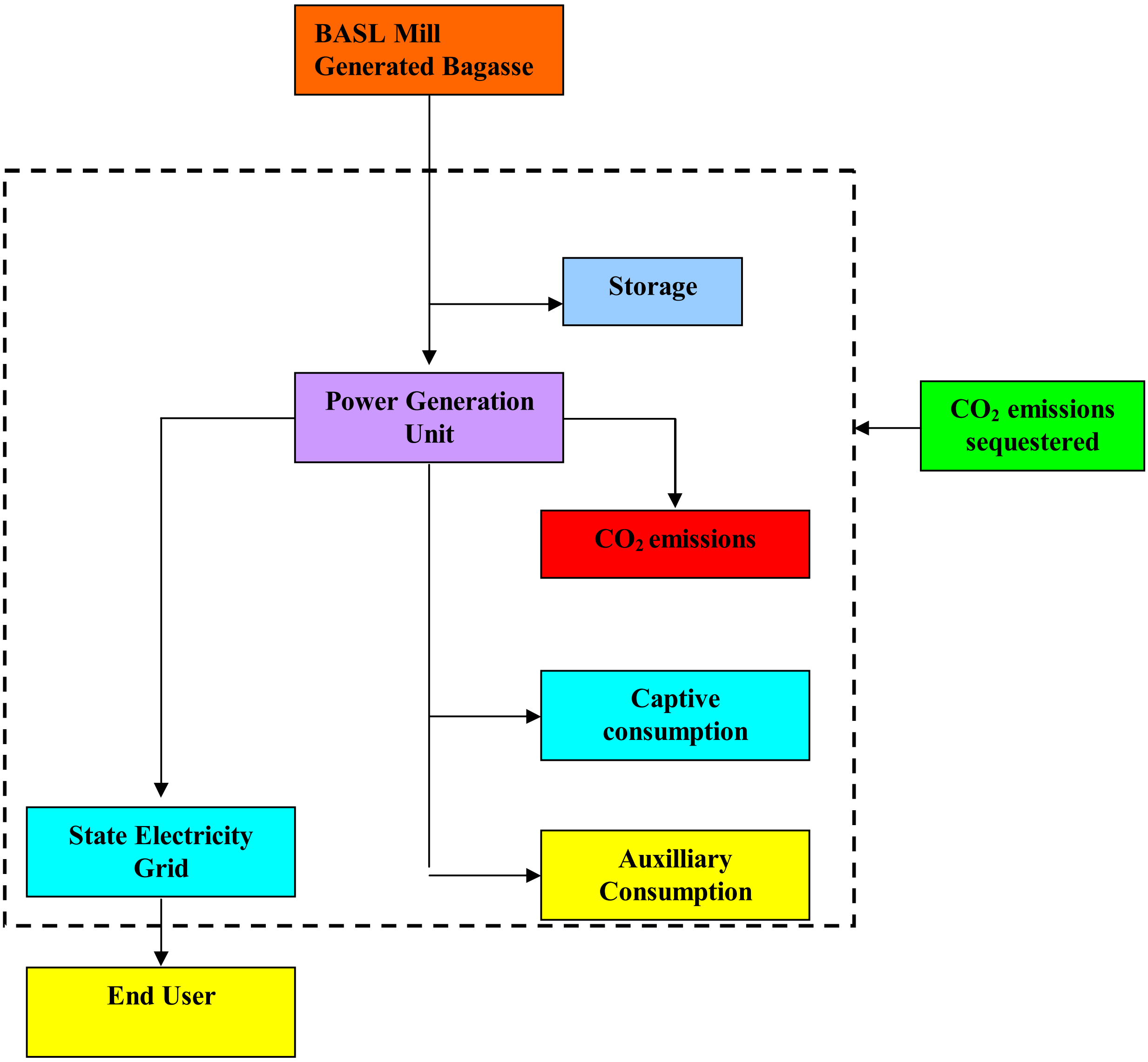

Figure B.1: Project boundary

	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	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. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Scenario	Onsite fossil fuel or electricity consumption 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.

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		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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The baseline scenario 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 94 TPH to 141 TPH. In the absence of the CDM project activity, BASL had the following baseline options:

Baseline option 1 (BA1):

- 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 while the 43 ata 7.5 MW power plant would be de-commissioned
- 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 option 2 (BA2):

- Continuation of the existing biomass residue fired cogeneration systems (67 ata 16 MW system and 43 ata 7.5 MW system)
- A low pressure low capacity heat only boiler would be installed 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 cogeneration systems. The surplus after meeting the total captive power requirements would be exported to the grid
- Surplus bagasse would be dumped or left to decay

Determination of the most plausible baseline scenario:

As defined in the consolidated methodology ACM0006, the realistic and credible alternatives have been separately determined for power generation, heat generation and biomass. Steps 3 (Barrier analysis) of the "tool for the assessment and demonstration of additionality" is used to analyse the above two options and determine the most plausible baseline alternatives:

Alternatives for power generation: How power would have been generated in the absence of the project activity?

1. As per baseline option BA1 above, the proposed project activity not undertaken as a CDM project activity is a likely baseline option (Option P1 as per ACM0006).
2. As per baseline option BA2 above, power would be partly generated at the existing biomass fired power plants (Option P5 of ACM0006) and partly in grid connected power plants (Option P4 of ACM0006)

Identification of most likely baseline power generation scenario using barrier analysis:

The option 1, implementation of the project activity without undertaking it under CDM, was a possible option available to BASL. However, there were some prohibitive barriers to its implementation as described in section B.5. There are no national policies or regulations requiring the implementation of the project activity. In view of the above, this option would not be a plausible attractive baseline alternative for BASL.

In option 2, BASL would continue operating the existing biomass residue fired cogeneration plants. The existing cogeneration systems were generating a surplus power of 12 MW and exporting it to the grid. BASL could easily meet the additional power requirement of around 2 MW from the existing cogeneration plants. There are no regulatory or policy barriers preventing the use of power from the existing power plants. This alternative would not involve any additional investment or risk and therefore would be a plausible alternative for BASL.

A summary of the barrier analysis for the above two alternatives are provided below:

Barriers	**Options**	
	P1	**P4 and P5**
Technological	Yes	No
Policy	Yes	No
Climatic	Yes	No

The most likely baseline power generation option is a combination of options P4 and P5.

Alternative for steam generation: How heat would be generated in the absence of the project activity?

1. As per baseline option BA1 above, the proposed project activity not undertaken as a CDM project activity is a likely baseline option (Option H1 as per ACM0006).
2. As per baseline option BA2 above, heat would be generated in existing boilers and in a new low pressure biomass fired boiler (Option H4 of ACM0006)

Identification of most likely baseline heat generation scenario using barrier analysis:

The option 1, implementation of the project activity without undertaking it under CDM, faced some prohibitive barriers to its implementation as described in section B.5. There are no national policies or regulations requiring the implementation of the project activity. In view of the above, this option would not be a plausible attractive baseline alternative for BASL.

The option 2, generation of steam in existing boilers and in a new low pressure (14 ata) low capacity boiler is risk free option. The investment involved would also be very low compared to option 1 and therefore option 2 is a plausible baseline alternative for BASL.

A summary of the barrier analysis for the above two alternatives are provided below:

Barriers	**Options**	
	H1	**H4**
Technological	Yes	No
Policy	Yes	No
Climatic	Yes	No

The most likely baseline heat generation option is H4.

Alternatives for use of biomass: What would happen to the biomass in the absence of the project activity?

1. As per baseline option BA1 above, the biomass would be used for heat and electricity generation in a high pressure cogeneration system at the project site (Option B4 as per ACM0006)
2. As per baseline option BA2 above, the biomass would be partly used for heat and electricity generation at the project site (Option B4 as per ACM0006) and partly dumped or left to decay (Option B1 as per ACM0006)

Identification of most likely baseline biomass scenario using barrier analysis:

The first option (implementation of the project activity not undertaken as a CDM project activity) cannot be a baseline alternative since it faces prohibitive barriers (Refer Section B.5) to its implementation. There are no legal and regulatory requirements for implementation of the high pressure cogeneration system.

In the second option, bagasse would have been partly used to generate heat and power at the project site in the existing cogeneration systems and in a new low pressure boiler. The surplus bagasse would have been dumped or left to decay. This alternative does not face any barriers and is in compliance with all regulatory requirements and could be a likely baseline scenario.

A summary of the barrier analysis for the above two alternatives are provided below:

Barriers	**Options**	
	B4	**B4 and B1**
Technological	Yes	No
Policy	Yes	No
Climatic	Yes	No

The most likely baseline biomass scenario would be a combination of options B4 and B1.

Most plausible baseline scenario for the project activity:

The above analysis shows that the most likely baseline scenario is the "Baseline option 2" described above in this section, which is a combination of:

Options P4 and P5 for power generation

Options H4 for heat generation

Option B4 and B1 for biomass residues

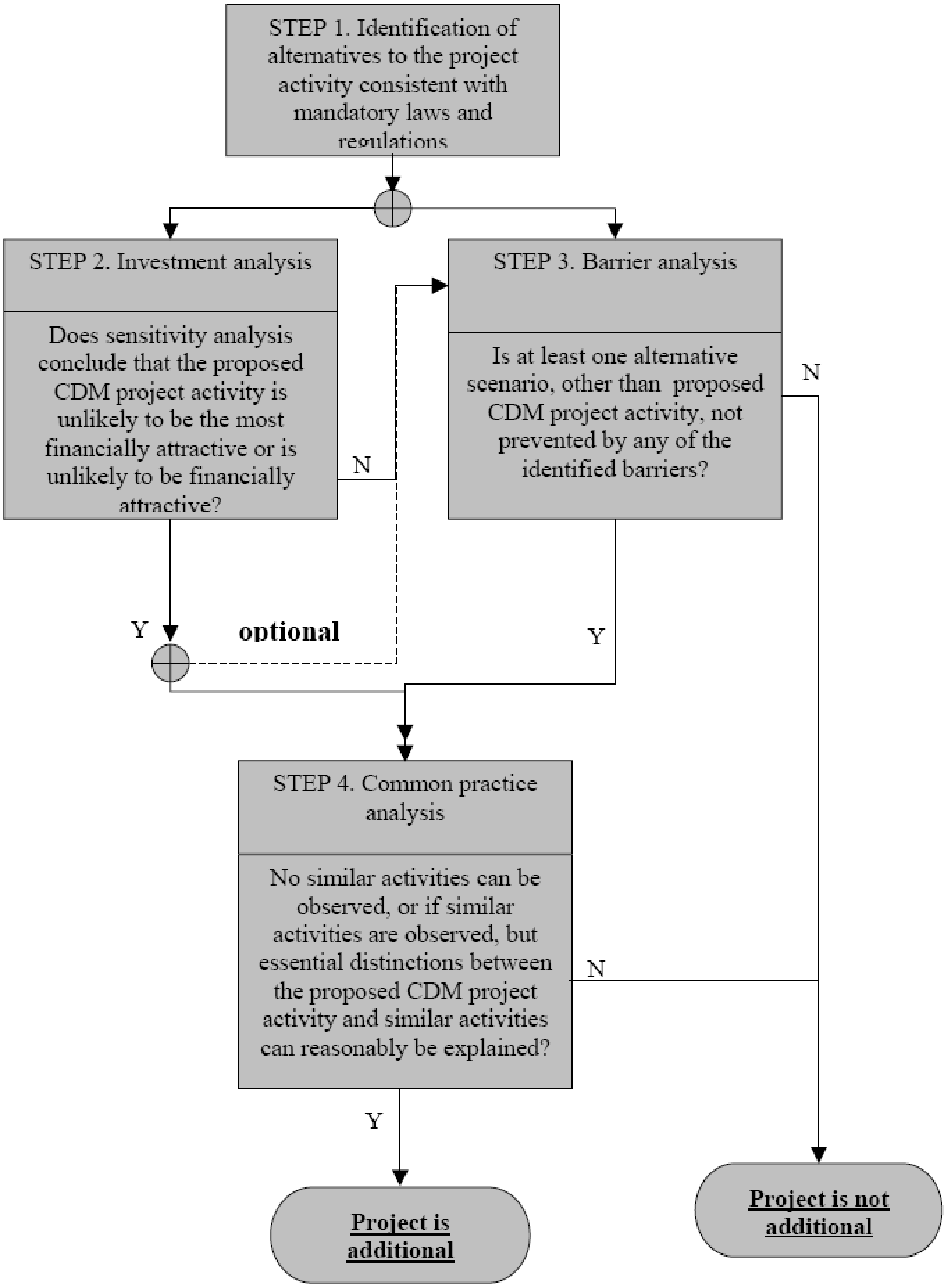
The above combination of baseline scenarios for power, heat and biomass is applicable under scenario 16 of ACM0006.

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): >>

BASL conceptualized the power capacity expansion project activity during year 2002 along with its sugar plant capacity expansion. The BASL Board approved the proposal considering the CDM benefits and subsequently the construction activity commenced on 14 September 2002. The project activity has started operation (on March 2004) before registration with the UNFCCC as a CDM project activity since a suitable methodology was not available.

BASL's project activity generates clean electricity using CO_2 neutral bagasse as fuel and the surplus electricity from the project activity is supplied to the southern regional grid. In the business as usual (BAU) scenario, BASL would not have implemented the project activity which is demonstrated using the latest UNFCCC "Tool for the demonstration and assessment of additionality" (Version 03 – Refer Figure B.2 below) as prescribed by ACM0006. The equivalent quantity of electricity would be generated from power sources in the grid. Considering the existing grid generation mix and the recent capacity additions, fossil fuel based power plants are likely to dominate the generation mix with a CO_2 emission factor of 0.86 kg CO_2/kWh. Therefore, it may be stated that the implementation of the CDM project activity reduces GHG emissions that would otherwise occur in the CO_2 intensive grid sources.

Figure B.2: Tool for demonstration of additionality



Demonstration and Assessment of Additionality:

B.5.1 Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations

The sub-steps include:

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

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

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 1.a: Define alternatives to the project activity

As described in section B.4 above, BASL had the following two alternatives to the project activity:

Option 1:

Option P4 and P5: Power generation in existing and new grid connected power plants and partly in existing power plant at the project site fired with the same type of biomass as the project activity.

Option B1 and B4: Partly left to decay and partly in existing plants at the project site to generate heat and power.

Option H4: In biomass fired boilers at the project site.

Or

Option 2:

The implementation of the project activity not undertaken as a CDM project activity.

Sub-step1.b. Enforcement of applicable laws and regulations

Option 1:

There is no law or legislation that restricts the power generation in existing and new grid connected power plants and in existing power plants at the project site fired with the same type of biomass as the project activity.

There is no law or legislation that restricts leaving the biomass to decay or its use in existing plants at the project site to generate heat and power.

There is no law or legislation that restricts heat generation in biomass based boilers at the project site.

Option 2:

The implementation of the project activity (utilising the surplus biomass for power generation) not undertaken as a CDM project activity is not restricted by any applicable law or legislation.

Thus, both the above options satisfy all applicable laws and regulations of the country.

B.5.2 Investment analysis or Barrier analysis

The next step for additionality justification as per the Fig B.2 is either

Step 2 - Investment analysis (OR)

Step 3 - Barrier analysis

Step 3 – Barrier analysis is adopted 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

Sub-step 3a: 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.

Prior to the project activity, in the year 2000-01, BASL had installed a similar high pressure configuration cogeneration system at its sugar factory. After commissioning of the system, BASL faced technical difficulties regarding the operation, maintenance and performance of the system. The technical problems faced included scaling of TG, boiler tubes erosion, "load hunting", "furnace puffing" and gear box vibrations. The TG scaling problem resulted in shut down of the plant for 27 days (out of the 280 working days) in the year 2000-01 resulting in significant revenue loss and higher maintenance expenditure.

Thus, BASL's earlier experience with a similar configuration cogeneration system raised uncertainties regarding the high pressure technology. In such circumstances, BASL was apprehensive of implementing a similar risky technology at a high investment when its energy requirements could be met with comparatively minimal investment and low risk technology (low pressure boiler). The uncertainties in power purchase tariff for power export, described under "other barriers", further emphasised the risks to the financially sustainable operation of the project activity.

Other Barriers:

Policy risk:

The recovery of investment from the project mainly depended on the power purchase tariff offered by the regional electricity authority. Though bagasse cogeneration projects were being offered reasonable power purchase tariffs, the government of Karnataka passed a new detailed power policy in January 2001 that focussed on tariff rationalization and restructuring to improve the financial situation of the electricity utilities. In view of this, it was expected that the power purchase tariffs would undergo a revision that may not be favourable to cogeneration projects. BASL was apprehensive of this risk over which they have limited or no control. In fact, BASL's apprehension became a reality as the power purchase tariff offered to the project activity was 20% lower (Rs.2.80 per kWh) than the expected tariff (Rs.3.49 per kWh).

Climatic risk:

Another significant barrier has been BASL's apprehension that climatic factors would reduce bagasse availability and affect the profitable operation of the project activity. Since the project activity depends on bagasse as the fuel, its profitable operation is in collateral with that of the cane availability (rainfall). The reduced cane availability to the sugar factory would result in the non-availability of fuel (bagasse) for the project activity resulting in its lower capacity utilisation. BASL's apprehension has unfortunately transformed in to a reality. The sugarcane belt supplying the sugar factory has suffered severe drought in the two years subsequent to the implementation of the project activity and as a result, cane output reduced considerably in the region. The sugar factory has been operating below capacity (3300 TCD in 2004-05 and 4300 TCD in 2005-06) against the rated capacity of 7500 TCD, incurring huge revenue losses due to very low capacity utilisation. The investment made on the sugar capacity expansion from 5000 TCD to 7500 TCD remains idle without any returns. Since the project activity depends on bagasse as the fuel, the reduced crushing in the sugar factory resulted in the non-availability of fuel (bagasse) for the project activity resulting in its operation at less than 50% of its rated capacity. This has resulted in considerable loss of revenue to BASL in the last two years. BASL hopes to offset part of the losses incurred using the revenues from sale of CERs.

BASL's management took the decision to pursue the project activity amidst of the uncertainties involved considering that the prospective CDM revenues would help in offsetting the impact of these uncertainties.

Additionality test for Regulatory/Legal requirements

There is no legal binding on BASL to take up the project activity.

- There is no regulation requiring the installation of high pressure cogeneration system
- There is no regulation requiring the use of surplus biomass for power generation
- There is no regulation against the generation of steam and power in low pressure cogeneration systems

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

In the absence of the project activity, the additional power requirement would have been met from the existing cogeneration units and the additional heat requirement by installing a low pressure boiler. The surplus bagasse would have been dumped or left to decay.

***Technological barrier**:*

In the alternative scenario to the project activity, a low pressure boiler (14 ata) would be installed to meet the additional steam requirements. In Indian sugar mills, steam generation from low pressure boilers is a well established common practice and would not face any technological barriers in its implementation.

Climatic risks:

The alternative scenario would require comparatively minimal investment and therefore the impact of climatic vagaries would not be a significant factor to its implementation.

Policy risks:

Since there would be no additional power export to grid in the alternative scenario, barriers associated with power purchase agreements; electricity policies etc would not prevent the implementation of the alternative scenario.

Therefore, the barriers to the implementation of the project activity do not exist for the wide spread implementation of the alternative options available to BASL.

B.5.4 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. or 6.5%*
Source: Karnataka Renewable Energy Development Limited (KREDL): http://nitpu3.kar.nic.in/kredl/venture/score3.htm#Co 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[2] than that of BASL project activity that make them more financially robust than that of the project activity.

[2] 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.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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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)

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

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

Where:

BFi,y	is the quantity of biomass type i, 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,CO_2}	is the average CO_2 emission factor for the trucks measured in 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 for the preparation 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 that are attributable to the project activity during the year *y* (mass unit per year)
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 excluding that of the power plant auxiliary[3] equipments would be monitored. Corresponding project emissions would be calculated as follows:

$\mathbf{PE_{EC,y} = EC_{PJ,y}\ x\ EF_{grid,y}}$

Where,

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

$PE_{EC,y}$ is CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)

$EC_{PJ,y}$ is on-site electricity consumption attributable to the project activity during the year y (MWh)

$EF_{grid,y}$ is CO_2 emission factor for grid electricity during the year y (tCO_2/MWh)

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)

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:

$$EG_y = \mathrm{MIN}\left\{\begin{array}{c} EG_{\text{project plant, y}} \\ \mathrm{EG}_{\text{total, y}} - \dfrac{\mathrm{EG}_{\text{historic,3 yr}}}{3} \end{array}\right\}$$

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.

Determination of electricity baseline emission factor (EF_y):

As 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). 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:

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

For calculations, local values of NCV_i and $EFCO_{2i}$ 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.

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.

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of South India Regional grid mix.

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 ACM0006. 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).

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 ($ER_{heat,y}$). In scenario 16, the emission reductions due to displacement of heat are due to the displacement of heat generation in fossil fuel boilers with heat generation in the project activity. In BASL case, the baseline is not a fossil fuel based boiler and therefore there would not be any emission reduction due to displacement of heat.

Therefore, it is assumed that $ER_{heat,y} = 0$ for this project activity.

B.6.1.4: Leakage:

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. This is demonstrated below using the option L3 as prescribed in the ACM0006:

Option L3:

1. *"Demonstrate that suppliers of biomass in the region of the project activity are not able to sell all of their biomass"*

   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. BASL would provide proof from the biomass suppliers in the region that they had surplus biomass which could not be sold.

Therefore there is no leakage of emission reductions likely from the project activity. If for a certain type of biomass *i* 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:

$$L_y = COEF_{co2,j} . \sum_i BF_{i,notused,y} .NCV_i$$

where:

Ly	are the leakage emissions during the year y in tons of CO_2,
$COEF_{CO2,j}$	is the CO_2 emission coefficient (per energy unit) of the most carbon intensive fuel used in the country,
$BF_{i,notused,y}$	is the quantity of biomass type *i* used as fuel in the project plant during the year *y*, which would in the absence of the project activity not used, i.e. be dumped, left to decay or burned in an uncontrolled manner without utilizing it for energy purposes, expressed in tonnes
i	are the types of biomass for which leakage effects could not be ruled out with one of the approaches L1, L2 or L3,
NCV_i	is the net calorific value of the biomass type i (per volume or mass).

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) 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:

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

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

Data / Parameter:	**$EG_{historic, 3yr}$**
Data unit:	MWh
Description:	Energy Generation of all the existing power plants at the project site in the most recent three years prior to the project activity
Source of data used:	BASL
Value applied:	345,999 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 in years 2001, 2002 and 2003 has been considered.
Any comment:	

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	$FF_{project\ plant,y}$	Quantity of fossil fuel used	T/yr	0	Will be measured if used. Envisaged only during emergencies.
2	$FF_{projectsite,y}$	Quantity of fossil fuel used	T/yr	0	Will be measured if used. Envisaged only during emergencies.
3	NCV	Calorific Value	TJ/T coal	0.020784	Average calorific value of coal used in grid connected power plants based on CEA data.
4	EF_{CO2}	CO2 emission factor	tCO_2/TJ	96.1	IPCC default value
5	$PEFF_y$ ((1+2)*3*4)	CO2 emissions from coal	tCO_2/yr	0	Methodology formula

Emissions due to combustion of fossil fuels for transportation of biomass:

6	BF_y	Quantity of biomass bought and transported from outside	T/yr	0	Only expected during bagasse shortage
7	TL_y	Average truck load of the trucks used	T	10	Average rated tonnage of trucks used
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		Fuel consumption per 1000 kilometer	kg/000'kms	205	Based on truck mileage of 4 kms/litre diesel
10		CO2 emission factor	kgCO2/kg fuel	3.16	IPCC default value
11	$EF_{km,CO2}$ (9*10)/1000	Average CO2 emission factor of the trucks	kgCO2/km	0.6478	Methodology formula
12	PET_y ((6*8*11) / (7))	CO2 emissions from diesel	tCO2	0	Methodology formula
13	PE_y (5+12)	Total Project Emissions	tCO2	0	Methodology formula

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	$BF_{i,notused,y}$	Quantity of biomass type *i* used as fuel in the project plant during the year *y*, which would in the absence of the project activity not used, i.e. be dumped, left to decay or burned in an uncontrolled manner without utilizing it for energy purposes, and 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.
2	NCV_i	Net calorific value of the	MCal/T	-	Calorific value of the

		biomass type i (per volume or mass).			fuel for which leakage cannot be ruled out will be measured. However, no leakage is envisaged.
3	$COEF_{CO2,j}$	CO_2 emission coefficient (per energy unit) of the most carbon intensive fuel used in the country	tCO_2/MJ	-	CO_2 emission coefficient of the most carbon intensive fuel in the country will be determined from published national data.
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 Kg/cm^2 system in year y	MWhe	108,528	Based on 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	0.86	Refer Annex 3
8	$ER_{electricity}$ (6)*(7)	Emission Reduction due to displacement of electricity	tCO_2	73,007	Methodology Formula

Emission reductions

S.No	Notation	Parameter	Unit	Value
1	$ER_{electricity,y}$	Emission Reductions due to displacement of electricity	tCO_2/yr	73,007
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	73,007

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

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Sr. No.	Operating Years	Baseline Emission Factor EFy	Incremental electricity generation EGy	Electricity Emission reductions BEy	Project Emissions PEy	Leakage Ly	Certified Emission Reductions - CERs
		(tonnes of CO_2 / MWh)	(MWh)	(tonnes of CO_2)	(tonnes of CO_2)	(tonnes of CO_2)	(tonnes of CO_2)
1.	2007 – 08	0.86	84,893	73,007	0	0	73,007
2.	2008 – 09	0.86	84,893	73,007	0	0	73,007
3.	2009 – 10	0.86	84,893	73,007	0	0	73,007
4.	2010 – 11	0.86	84,893	73,007	0	0	73,007
5.	2011 – 12	0.86	84,893	73,007	0	0	73,007
6.	2012 – 13	0.86	84,893	73,007	0	0	73,007
7.	2013 – 14	0.86	84,893	73,007	0	0	73,007
8.	2014 – 15	0.86	84,893	73,007	0	0	73,007
9.	2015 – 16	0.86	84,893	73,007	0	0	73,007

10.	2016 – 17	0.86	84,893	73,007	0	0	73,007
	2007-2017		**848,930**	**730,070**	**0**	**0**	**730,070**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$BF_{i,y}$**
Data unit:	Tonnes
Description:	Quantity of biomass type *i* combusted in the project plant during year y
Source of data to be used:	BASL
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: Monthly and annual mass and energy balance in the sugar plant supported by RT 8C forms submitted to the Government of India Outside biomass: Weigh bridge Recording Frequency: Continuously Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	Any direct measurements with mass or volume meters at the plant site will be cross-checked with annual energy balance that is based on fuel generated in-house, purchased quantities and stock exchanges Weigh bridge will be calibrated periodically
Any comment:	Annual energy balance will be prepared. Includes the quantity of biomass used in other boilers to generate the quantity of steam diverted from them, if any, to the project plant

Data / Parameter:	***Moisture content of the biomass residues***
Data unit:	% water content
Description:	Moisture content of each biomass residue
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50% (Bagasse)
Description of	It is monitored continuously where the mean values are calculated at least annually

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**AVD_y**
Data unit:	Kilometres (Kms)
Description:	Average return trip distance between biomass fuel supply sites and the project site
Source of data to be used:	Truck operator
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 Recording Frequency: Continuously Proportion of data to be monitored: 100%
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
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:	BASL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10 Recording Frequency: Continuously Proportion of data to be monitored: 100%
Description of measurement methods and procedures to be applied:	Average carrying capacity of trucks. Measured in BASL weigh bridge.
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:	**$EF_{km, CO2}$**
Data unit:	t CO_2/km
Description:	Average CO_2 emission factor for transportation of biomass with trucks
Source of data to be used:	IPCC and Truck operator
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:	Calculated using mileage data provided by the truck operators. Recording Frequency: Annually Proportion of data to be monitored: Sampling
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:	Local or national data will be used. Default values from the IPCC will be used alternatively and chosen in a conservative manner.

Data / Parameter:	**$EF_{CO2, i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for fuel type i
Source of data to be used:	Analysis reports of fuel used or local/national data or IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	96.1
Description of measurement methods and procedures to be applied:	Analysis shall be carried out by a reputed third party laboratory
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:	Local values / IPCC Guidelines/Good Practice

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
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel is measured at the BASL weigh bridge before their unloading into the project site. Recording Frequency: Continuously Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities will be checked with purchase receipts.
Any comment:	

Data / Parameter:	**$FF_{project\ site\ i,y}$**
Data unit:	Tonnes
Description:	Onsite fossil fuel consumption of type 'i' used in the project site apart from co-firing
Source of data to be used:	BASL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel is measured at the weigh bridge before their unloading into the project site.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities will be checked with purchase receipts
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
Value of data applied	0

for the purpose of calculating expected emission reductions in section B.5	
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
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:	BASL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Calculated 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
Description:	Net quantity of electricity generated in the project plant during the year y
Source of data to be used:	BASL
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:	Measured by calibrated energy meters of BASL Recording Frequency: Continuously Proportion of data to be monitored: 100%
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:	Net electricity will be arrived as the difference between gross electricity generation and auxiliary consumption

Data / Parameter:	$\mathbf{EG_{total,y}}$
Data unit:	MWh
Description:	Net quantity of electricity generated in all power generating units
Source of data to be used:	BASL Energy meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	212,004
Description of measurement methods and procedures to be applied:	Measured by calibrated energy meters of BASL Recording Frequency: Continuously Proportion of data to be monitored: 100%
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:	Net electricity will be arrived as the difference between gross electricity generation and auxiliary consumption

Data / Parameter:	$\mathbf{NCV_{i,FF}}$
Data unit:	TJ/T
Description:	Calorific value of fossil fuel
Source of data to be used:	BASL, Certified third party
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.04522

Description of measurement methods and procedures to be applied:	Samples of the fossil fuel will be sent to a certified third party agency. The NCV is determined in calorimeters of a certified third party agency. Recording Frequency: Annually Proportion of data to be monitored: Sampling
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 determined when fossil fuel is used

Data / Parameter:	**EG_{export}**
Data unit:	MWh
Description:	Net quantity of incremental electricity generated and supplied to the grid by the project
Source of data to be used:	BASL/CESCOM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	84,893
Description of measurement methods and procedures to be applied:	Measured by CESCOM Energy Meter in BASL premises. Recording Frequency: Continuously Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	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:	Though ACM0006 does not necessitate monitoring of this parameter, it is measured for QC procedures. Measured by CESCOM Energy Meter in BASL premises. Double check by receipt of sales.

Data / Parameter:	**$NCV_{i,BF}$**
Data unit:	TJ/T
Description:	Net calorific value of biomass
Source of data to be used:	BASL, Certified third party agency
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-

Description of measurement methods and procedures to be applied:	Samples of the fuel will be sent to a certified third party agency. The NCV is determined in calorimeters of a certified third party agency. Recording Frequency: Annually Proportion of data to be monitored: Sampling
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 of type i that could not be sold or is not utilized at a representative sample group of biomass suppliers
Source of data to be used:	BASL/Biomass suppliers
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 Recording Frequency: Annually Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$BF_{i,y}$ (Leakage)**
Data unit:	Tonnes
Description:	Quantity of biomass type *i* combusted in the project plant during year y for which leakage effects cannot be ruled out
Source of data to be used:	BASL
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:	If in a year BASL is not able to demonstrate the absence of leakage for a certain quantity of biomass using one of the options L1, L2 and L3 of ACM0006, then leakage shall be calculated and deducted for that quantity of biomass Recording Frequency: Annually

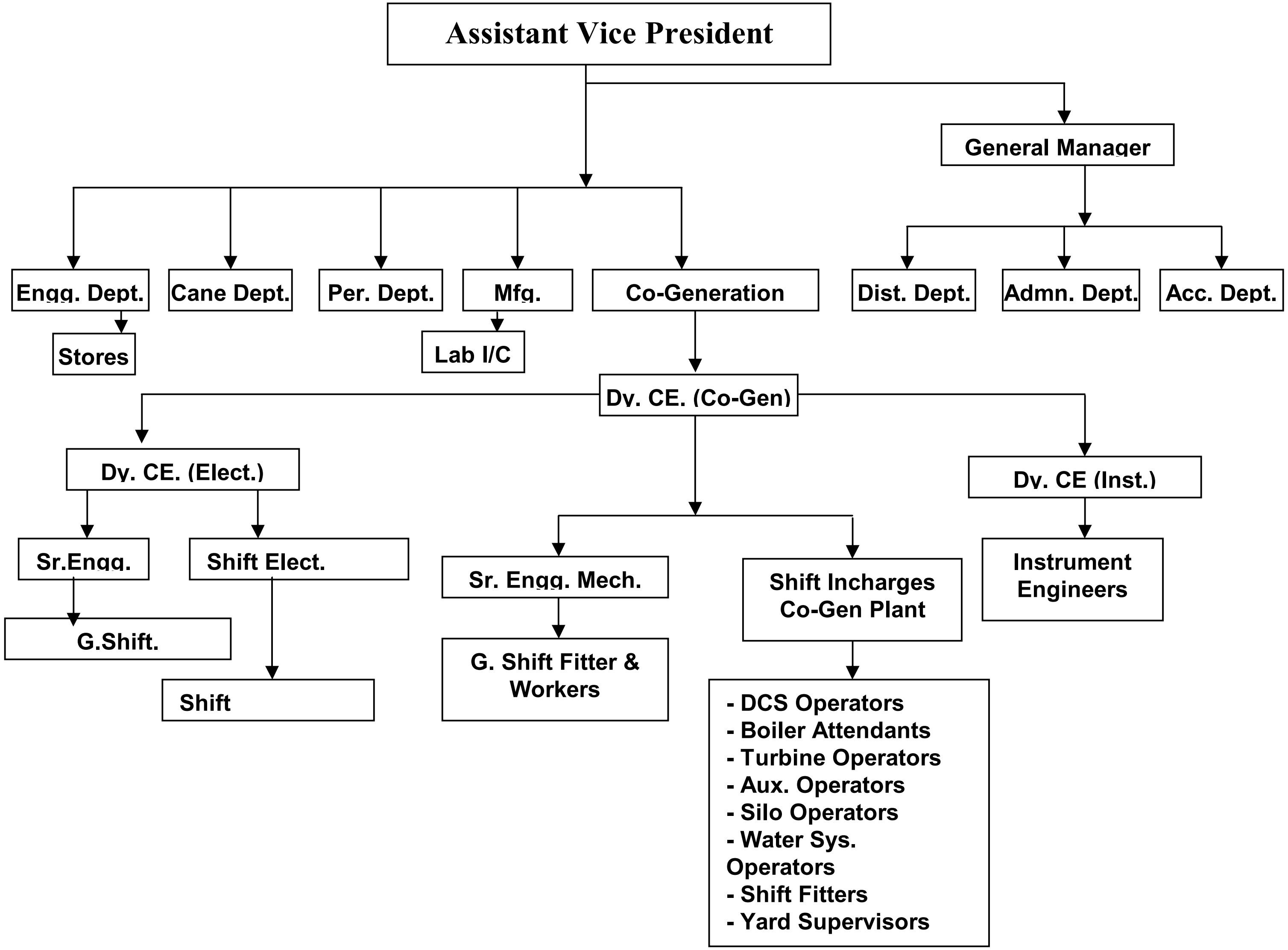
	Proportion of data to be monitored: 100%
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$EF_{CO2,j}$**
Data unit:	tCO_2/GJ
Description:	CO2 emission factor of the most carbon intensive fuel in the calculation of the combined margin using ACM0002
Source of data to be used:	Central Electricity Authority (CEA) published values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- (Leakage is not envisaged)
Description of measurement methods and procedures to be applied:	Will be calculated using Calorific value of fuel from CEA reports Recording Frequency: Annually Proportion of data to be monitored: Sampling
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

Project proponent will implement the following operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity. 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 this section. 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 seniors 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 weekly basis, these reports will be forwarded at the management level. Further details are provided in Annex 4.


Assistant Vice President
General Manager
Engg. Dept.
Cane Dept.
Per. Dept.
Mfg.
Co-Generation
Dist. Dept.
Admn. Dept.
Acc. Dept.
Stores
Lab I/C
Dy. CE. (Co-Gen)
Dy. CE. (Elect.)
Dy. CE (Inst.)
Sr.Engg.
Shift Elect.
Sr. Engg. Mech.
Shift Incharges Co-Gen Plant
Instrument Engineers
G.Shift.
Shift
G. Shift Fitter & Workers
- DCS Operators
- Boiler Attendants
- Turbine Operators
- Aux. Operators
- Silo Operators
- Water Sys. Operators
- Shift Fitters
- Yard Supervisors

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:

30/05/2007

Name of person/entity determining the baseline:

M/s. Bannari Amman Sugars Ltd

Unit II, Alaganchi Village

Nanjankud – 571 301

Karnataka

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:

>>

01/09/2007 or upon Registration with UNFCCC whichever is later

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:

>>

Assessment of Environmental Impact due to the project activity is carried out. A separate EIA summary report is available as Enclosure – I.

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

>>

Host party regulations requires BASL to obtain environmental clearance in the form of "No objection Certificate" from Karnataka State Pollution Control Board (KSPCB). The other condition is that the site of the project is to be approved from the environmental angle and that the Environmental Management Plans are to be prepared and submitted to the pollution control board. Environmental Impact Assessment has been conducted for the cogeneration of Power (20MW) and the study indicates that the impacts of the project are not significant. 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 following consents were obtained from the State Pollution Control Board (KPCB) for the 20 MW bagasse based cogeneration plant (Project Activity):

- Consent under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 (Central Act 14 of 1981) as amended
- Consent under Section 25/26 of the Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended.

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) has established the 20 MW bagasse based cogeneration plant at their sugar factory premises (project activity) during March 2004. The project activity uses mill-generated bagasse as a fuel.

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. Karnataka Pollution Control Board (KPCB)
4. Karnataka Power Transmission Corporation Limited (KPTCL)

Representatives of BASL met with the identified stakeholders and briefed them about the CDM project activity. Upon discussions, the stakeholders have expressed their support for the project activity through written communication. Copies of all the stakeholder responses are available with the project promoter and would be produced to the Validator.

Stakeholders list includes the government and non-government parties, which are involved in the project activity at various stages. BASL also has obtained necessary clearances from the government for setting up the project activity. BASL communicated to the relevant stakeholders to provide necessary comments on the project activity.

E.2. Summary of the comments received:

>>

Stakeholders Involvement

Local population

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.

Local population comprises of mainly farmers in and around the project area. The comments from the President of the local cane growers' association, representing the farmers in the area, have been documented. The role of the local people is as a beneficiary of the project. They supply raw material *i.e.* sugar cane for sugar mills and biomass for cogeneration. In addition to this, it also includes local manpower working at the plant site. Since, the project will provide good direct and indirect employment opportunities the local populace is encouraging the project.

The project activity will not displace any local population. In addition, the local population is also an indirect consumer of the power that is supplied from the power plants. This is essentially because the power sold to the grid has improved the stability in the local electricity network. Since, the distance between the electrical substation for power evacuation and the plant is not very high, installation of transmission lines will not create any inconvenience to the local population.

Thus, the project activity will not cause any adverse social impacts on local population rather will help in improvising their quality of life.

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.

The KPTCL and BASL have signed an agreement for parallel operation and supply/ purchase of surplus power from BASL, Nanjangud. The KPTCL shall draw power and therefore pay under the Section 43 of the Electricity (Supply) Act, 1948.

Stakeholders' Comments

BASL has already received the major necessary approvals and consents from various authorities, required for project implementation like Karnataka Electricity Regulatory Commission, Karnataka Power Transmission Corporation Limited, Karnataka State Pollution Control Board etc. All stakeholders have appreciated BASL's project activity and there were no negative comments from any of the stakeholders concerned.

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

>>

The BASL representative met the local NGOs and apprised them about the project and sought their support for the project. Relevant comments and important clauses mentioned in the project documents/clearances like Detailed Project Report (DPR), environmental clearances, power purchase agreement, local clearance *etc*. were considered while preparation of CDM project development document. As there was no negative feedback from the stakeholders, no corrective action was taken. As per UNFCCC requirement the PDD will be published at the validator's/UNFCCC web site for public comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Bannari Amman Sugars Limited
Street/P.O.Box:	Unit-II, Alaganchi Village
Building:	
City:	Nanjangud Taluk, Mysore District 571 301
State/Region:	Karnataka
Postfix/ZIP:	571 301
Country:	India
Telephone:	91 0821-228888, 228855, 228866, 228877
FAX:	91 0821-235014 (Fax)
E-Mail:	basngd@sancharnet.in
URL:	www.bannari.com
Represented by:	
Title:	Assistant Vice President
Salutation:	Mr.
Last Name:	R
Middle Name:	
First Name:	Ramagopal
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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 (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 (0.86 tCO_2/MWh) has been considered for this project activity.

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**1.1**
DATE	**21 Dec 2006**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**

EMISSION FACTORS

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.98	0.98	1.00	0.99	0.97
East	1.22	1.22	1.20	1.23	1.20
South	1.02	1.00	1.00	1.01	1.00
West	0.98	1.01	0.98	0.99	1.01
North-East	0.67	0.66	0.68	0.62	0.66
India	1.02	1.02	1.02	1.03	1.03

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.72
West					0.78
North-East					0.10
India					0.70

Combined Margin (tCO2/MWh)

(excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.76	0.76	0.77	0.76	0.75
East	1.06	1.06	1.05	1.07	1.05
South	0.87	0.86	0.86	0.86	0.86
West	0.88	0.89	0.88	0.88	0.90
North-East	0.39	0.38	0.39	0.36	0.38
India	0.86	0.86	0.86	0.86	0.86

Annex 4

MONITORING INFORMATION

Description of the Monitoring Plan

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

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

The project revenue is based on the units exported as measured by power meters at plant and check meters at the high-tension substation of the CESCOM. The monitoring and verification system would mainly comprise of these meters as far as power export is concerned. The export of electricity will be monitored through invoices to CESCOM.

The bagasse input is calculated based on cane crushed. The monitoring of quantity of bagasse used will produce evidence that the energy is being generated with zero net CO_2 emissions. The quantity of fossil fuels co-fired will be monitored to calculate project related emissions and can be verified with purchase invoices. The invoices, based on meter readings will also be covered in the regular finance audit.

The project employs latest state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters. Parameters monitored will be quantity and calorific value of bagasse fuel used, quantity and calorific value of fossil fuel used, total power generated, power exported to the grid, particulate matter emissions from the project, etc. (Details enclosed in the tables given below). These monitoring and controls will be the part of the Distributed Control System (DCS) of the entire plant. All monitoring and control functions will be done as per the internally accepted standards and norms of BASL.

The instrumentation system for the project comprises microprocessor-based instruments of reputed make with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

The quantity of emission reduction units claimed by the project will be only a fraction of the total generated emissions, which depends on the actual generation mix of the grid in a particular year.

BANNARI AMMAN SUGARS LTD; UNIT - II											
CDM MONITORING PLAN											
S No	**Data Description**	**Procedure for Monitoring the Parameter**	**Traceability of Inst. Calibration**	**Tag No / Eqpt. S No**	**Service & Tech. Deff.**	**Make of Inst.**	**Location of Inst.**	**Calibration Method**	**LC & range of Inst. / Accuracy Class**	**Uncertainity Class**	**Lincage with system Management**
1	Gross electricity Gen.16 MW TG	On line measurement	NABL	GEC01750	Ser: Electricity gen by 16 MW TG Deff: Tri vector Energy meter	M/s Secure Ltd	Generator Bus bar	As per the STD calibration procedure, by approved agency	Cl: .5 s, 3Ph, 3 wire 11KV/110V,1 A,50 HZ ,PF 1to -1		DCS Log, Log book
2	Gross electricity Gen.20 MW TG	On line measurement	NABL	E - 0001289	Ser: Electricity gen by 20 MW TG Deff: Tri vector Energy meter	M/s GE Multilin	Generator Bus bar	As per the STD calibration procedure, by approved agency	Cl: 0.2 s, 3Ph, 3 wire 11KV/110V,1 A,50 HZ ,PF 1to -2		DCS Log, Log book
3	Energy Export to KPTCL Grid	On line measurement	KPTCL	MainMetrer: 06607735 Check Meter: 06607761	Energy Export to KPTCL Grid Line deff: ABT Trivector Energy Meter	M/s L&T	66 KV Bus Bar	As per the STD calibration procedure, by KPTCL	Cl:0.2s 3 Ph, 4 wire, 1A, 110V		DCS Log, Log book
4	Steam flow(120tph boiler)	On line measurement		2FT704	120TPH Boiler steam flow measurement	Rosemount	120TPH Boiler	As per the STD calibration procedure, by BASL	0 to 170TPH	0.001 FS	DCS Log, Log book
5	Steam flow from 80 TPH Boiler to 20 MW TG	Steam flow (20MW TG)		2FT5101	20 MW TG steam inlet line	ABB	20MW TG	As per the STD calibration procedure, by BASL	0 to 160 TPH	0.001FS	DCS Log, Log book

6	Quantity of Bagasse Consumed (As per sugar plant DMR, prepared by using data from the equipment given here)	Raw juice flowmeter		MHJMFT02	Sugar plant Raw juice pump delivery line	Krohne Marshall	Boiling house	As per the STD calibration procedure, by BASL	0 to 450 cbmtr/hr	0.09FS	Daily Manufacturing Report, Log book
		Hot water flowmeter		MHIWTFM03	Sugar plant Mill house imbibition water pump delivery line	Krohne Marshall	Mill house	As per the STD calibration procedure, by BASL	0 to 200 cbmtr/hr	0.09FS	
		Cane Weigh bridge1	Dept. of Legal Metrology	EB01S016	Cane weight measurement	Avery (I) Ltd	Cane weighbridge office	As per the STD calibration procedure, by the Dept. of Legal Metrology, Govt of Karnataka.	0 to 30000kg ClassIII	10kg	
		Cane Weigh bridge 2		EB01S019	Cane weight measurement	Avery (I) Ltd	Cane weighbridge office		0 to 30000kg ClassIII	10kg	
7	Quantity of biomass / Bagasse purchased from out side	Sugar Weighbridge	Dept. of Legal Metrology	EBO2W126	Sugar,Molasses and Coal measurement	Avery (I) Ltd	Sugar weighbridge office	As per the STD calibration procedure, by the Dept. of Legal Metrology, Govt of Karnataka.	0 to 50000kg ClassIII	10kg	Log book, Purchase invoice
8	Quantity of Coal purchased										
9	Calorific Value of Biomass	Fuel Analysis by Reputed Lab									

10	Calorific Value of Coal	Fuel Analysis by Reputed Lab									
NABL: National Accreditation board for testing laboratories											

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

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

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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.